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BOTANIC & DOMAIN GARDENS

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Handbook of Forest Trees

FOR

VICTORIAN FORESTERS

By

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Many enquiries having been received for a handy work on Forest Trees of Victoria, for the use of students, the offer of Professor A. J. Ewart, Ph.D., D.Sc., to prepare it was gladly accepted by the Forests Commission of Victoria, who arranged for its publication in its present form.

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PREFACE.

This work is primarily intended to be of use to Forest officers and to students of Botany and Forestry. It deals with the botanical and economic side of Victorian Forestry. It is hoped, however, that it will be found useful to all who are interested in our native trees, and with this end in view the use of technical terms has been reduced to a minimum and simple keys for the identification of the different trees are given, as well as a figure of each species native to Victoria. In addition an account is included of the chief exotic soft woods, since a knowledge of these is important to the forester. A key is also given to the commoner exotic hardwood trees grown or planted in Victoria. A detailed description of the latter would, however, be far beyond the scope of this work and would be of little use to the forester, since our native hardwoods give us all we need in this class of timber.

In addition to the forest trees, the under scrub of a forest is of importance to a forester, so that an account is given of practically all shrubby forms which may exceed 10 or 15 feet in height. Similarly keys for the identification of the flowering parasites of trees have been added.

Where a group of trees is an important source of some product, such as tannin, oil, or honey, a special account of such products is given in addition to the notes under each species. The character and uses of the timber are set out under each species and a general account is given of the structure of wood and of the principles involved in the seasoning of timber.

The figures have all been specially drawn, either from nature or in some cases after the figures in Mr. Maiden's or in Baron von Mueller's numerous works. They are mainly the work of Mrs. Rossiter, Miss Gordon, Miss Kerr and Miss Adam, but a large number have been drawn by Dr. White,* Dr. McLennan, Miss Cookson, Miss Derrick, Miss Ellery, Miss Vincent, Miss Murrell and Mr. Patton.

Throughout the preparation of this work most useful assistance has been given by the Forest Commission and by the National Herbarium. The popular names used are those adopted by the Plant Names Committee of the Field Naturalists Club.

The preparation of this work was first undertaken at the suggestion of Viscount Novar when Governor-General of Australia. His interest in Forestry is well known, and to him this book is respectfully dedicated.

* NB. Subsequent married name T. White-Haney.

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Melbourne University,

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BOTANIC & DOMAIN GARDENS

THE STRUCTURE OF TIMBER.

The trees which are of importance to the Forester fall under two groups, the Dicotyledons or "broad-leaf trees" and the Conifers or "narrow-leaf trees." A few Monocotyledons, such as the palms, form tree-like stems, but their wood is not a pure tissue and is composed of small patches or bundles of wood (xylem) and soft bark (phloem) tissue, often closely massed together so as to form apparent wood tissue, which may be quite strong and hard, but which is, owing to its composite character, rarely durable and often difficult to work.

In the Conifers the wood is of a more simple and primitive character than in the Dicotyledons. In both cases the stem has two growing or cambium layers, each consisting of a thin layer of active living cells which are continually growing and dividing to add new cells to the stem and increase its bulk. The outer or cork-cambium lies between the hard outer and the soft inner bark. It corresponds to the layer beneath the skin of an animal, and like it, continually cuts off new cells externally which die and add to the thickness of the outer dead skin or bark. This peels or cracks off externally in time, although in many trees, stringy barks, &c., it may become very thick. According to the way the cork cambium develops, the bark may crack or scale irregularly (rough barks), or may split off in sheets or ribbons, leaving a smooth surface beneath (gums or smooth barks).

Conifer Wood.—The wood-cambium lies between the inner or soft bark and the outer surface of the youngest or sap wood. It consists in a conifer of a thin sheet of somewhat cylindrical cells elongated parallel to the length of the stem. Its divisions take place with great regularity. The segments cut off internally add new layers of wood and may form (*a*) wood fibres or tracheides, (*b*) medullary rays, (*c*) special elements, such as resin canals.

A cambium segment-cell in turning into a wood fibre transforms all its living contents into the cell-wall, which thickens and becomes lignified, but encloses a central cavity. At certain rounded or oval spots, the wall remains thin and the thickened part of the wall grows in over these on each side of the original thin cell-wall, forming what are known as bordered pits. These are shown in face view in Figs 2, 4 and 5, which are sections of Conifer wood cut lengthwise and parallel to a radius (Radial longitudinal sections). In a section cut lengthwise and at right-angles to a radius (tangential longitudinal) the bordered pits themselves are cut in section and appear as minute bead-like cavities in the wall of the fibre. Four of these are shown in the wall

marked A in Fig. 3. The wood fibres are not all alike. Those formed in autumn are thick walled and have small cavities (Fig. 1—A). Those formed in spring have larger cavities, thinner walls and well developed bordered pits mainly on their radial walls (Fig. 1—B). It is in this way that the annual rings so characteristic of Conifer wood are developed.

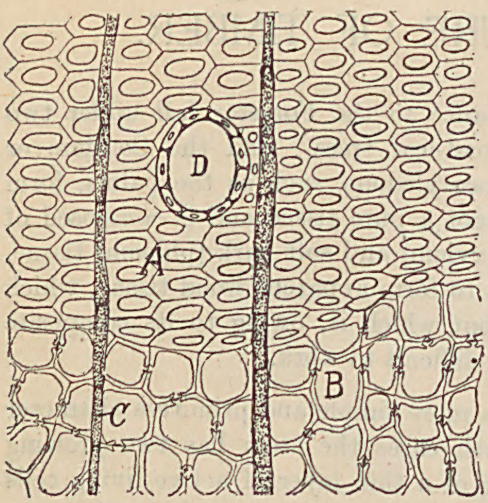

FIG. 1.

TRANSVERSE SECTION OF WOOD OF PINE.

A. Thick-walled wood fibres of Autumn wood at end of a year's growth. B. Thin-walled wood fibres of Spring wood. C. Medullary ray. D. Resin canal. (This and the following eleven figures all highly magnified.)

At certain points in its circumference the cells of the cambium divide parallel to their length as if about to form a wood fibre but the segment divides transversely usually into three to five shorter segments. This type of division continues for some time, leaving a streak of tissue in the wood, the cells of which usually retain their living contents for some years at least and form what is known as a medullary ray (Fig. 1—C). In the Pine the medullary rays may contain stored food materials (Fig. 2, C and Fig. 3, B) or may resemble short transversely running tracheides (Fig. 2, B and Fig. 3, C) communicating with one another and with neighbouring wood tracheides by means of small bordered pits (Figs. 2 and 4 at B). These cells serve to conduct water from the inner to the outer layers of wood or *vice versa*.

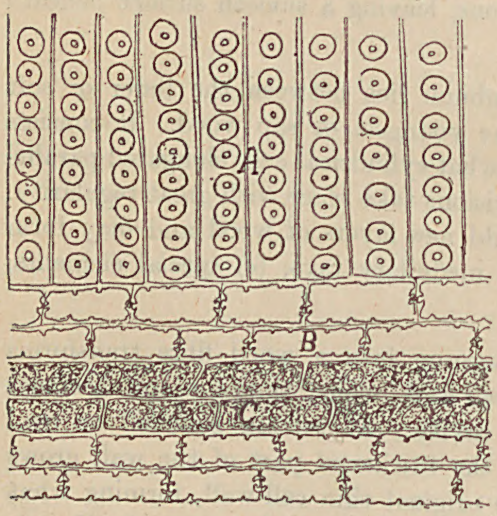

FIG. 2.

RADIAL LONGITUDINAL SECTION OF WOOD OF PINE.

A. wood fibres showing bordered pits in face view. B. tracheidal cells. C. storage cells of medullary ray.

At certain points in the cambial layer, along a longitudinal line often of considerable length, the segment cells formed at one interval of time remain active and undergo divisions both transverse and vertical to form a little group of glandular "resin" cells. These do not grow as rapidly as the cells around them and hence instead of filling the space allotted to them, they separate forming a lining layer around a central cavity. (D in Fig. 1). This is a resin canal. The resin is formed by the glandular lining layer. It contains turpentine

and is fluid when fresh. It solidifies on exposure to the air as the turpentine evaporates or oxidizes and thus forms a temporary healing

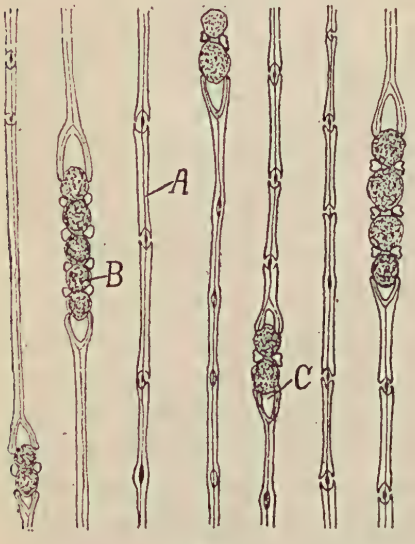

FIG. 3.

TANGENTIAL LONGITUDINAL SECTION OF PINE WOOD.

Showing A, bordered pits in the walls of the fibres; and B, storage; and C, tracheidal cells of the medullary rays which are cut transversely to their length.

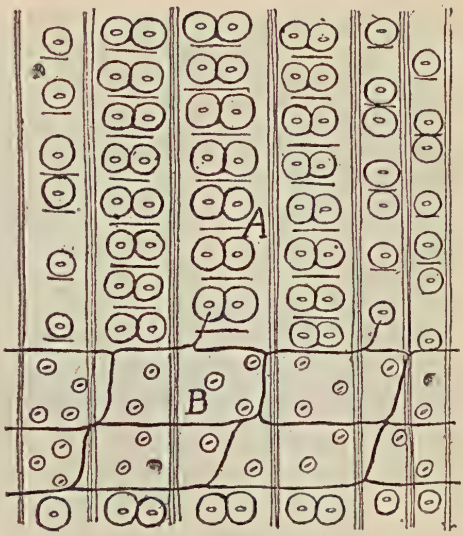

FIG. 4.

RADIAL LONGITUDINAL SECTION OF WOOD OF GINKGO.

Showing A, wood fibres with bordered pits in face view; B, a medullary ray crossing the wood fibres at right angles.

layer over cut surfaces or injuries. Resin canals occur in the soft bark as well as in the wood, and they sometimes produce blisters or resin pockets in the bark owing to the extravasation of the resin. The resin canals in the soft bark (cortex) of young shoots often form continuous channels extending into the leaves.

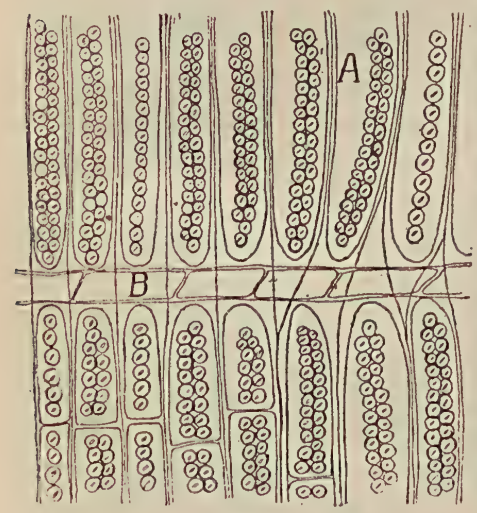

FIG. 5.

RADIAL LONGITUDINAL SECTION OF WOOD OF AGATHIS.

Showing wood fibres, A, mostly with double rows of bordered pits; and B, a medullary ray.

The structure of the wood varies in detail in different Conifers. Thus resin canals are absent from the wood of yews (*Taxus*). The fibres vary in their size, in the thickness of their walls, and in the arrangement of the bordered pits. Thus in both *Ginkgo* (Fig. 4—A) and in *Agathis* (Fig. 5—A) the bordered pits may occur in double rows on the fibres, although some of the fibres may show single rows only. The double rowed arrangement is common in many fossil Conifers.

The medullary rays may consist of only one kind of cell (Fig. 4—B) and may sometimes be extremely narrow. (Fig. 5—B).

The wood of the yew is peculiar in having small scattered bordered pits, which are particularly small where they lie between the tracheides and the medullary ray cells. The walls of the fibres are thickened internally by spiral or reticulate bands. It is this structure which gives yew wood that strength and resiliency which made it so valuable for bows when these were used in warfare.

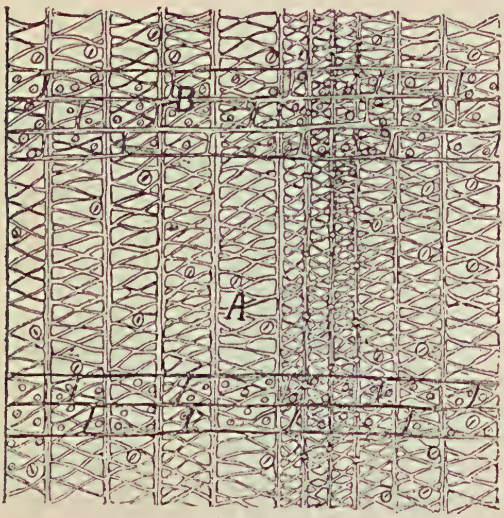

FIG. 6.

RADIAL LONGITUDINAL SECTION OF WOOD OF YEW (TAXUS).

Showing wood fibres; A, with small bordered pits, and reticulate or spiral thickenings on their walls; at B, a medullary ray three cells broad, and below A, one, two-cells broad.

Dicotyledonous Wood.—This develops in the same general way as in a Conifer except that resin canals are characteristically absent and that at certain points longitudinal chains of the cambium segments enlarge considerably and their end walls break down more or less completely, so that they form continuous tubes or pores in the wood known as the wood-vessels (*tracheae*), which when large are visible to the naked eye. Their chief function is to carry water upwards and, mainly in spring time, food materials as well, whereas the fibres are the strengthening or mechanical tissue of the wood. The vessels vary from a few millimetres to 20 feet in length, and from 0.03 m.m. diameter to as much as 0.5 or 0.6 of a millimetre. The hardness, and to some extent, the strength of a wood depends partly on the thickness of the walls of the wood fibres. Thus in Mountain Ash (*E. regnans*) the wood fibres have thinner walls and larger cavities than in the Redgum *E. tereticornis var. rostrata*) (cf. Figs. 7 and 8). The strength of a timber also depends on the character and kind of lignification in the walls of the wood fibres, on their length and on the fixity with which they are cemented together. In the making of wood pulp either by mechanical or chemical means (sulphurous

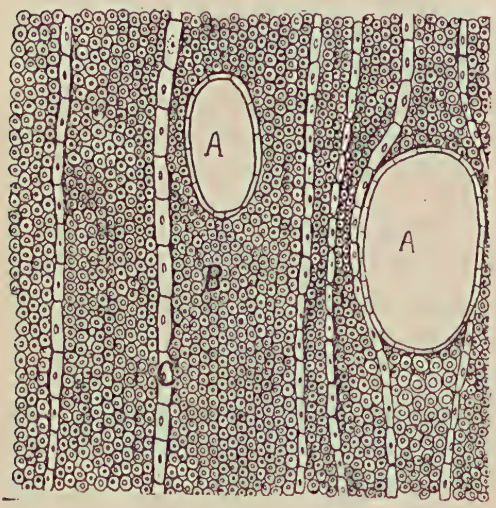

FIG. 7.

TRANSVERSE SECTION OF WOOD OF EUCALYPTUS TERETICORNIS VAR. ROSTRATA.

A, vessels. B, wood fibres. C, medullary rays.

acid, or hot alkali) the wood fibres are separated so as to form the soft pulp from which paper is made.

The value of a wood for paper-making depends mainly upon the readiness with which the fibres can be (*a*) separated and (*b*) felted together again. The latter mainly depends upon the ratio between their lengths and breadths. The fibres of Sitka Spruce average 2·8 mm. long by 0·05 mm. diameter, i.e., 56:1. Those of *Eucalyptus regnans* average 1 mm. long by 0·02 to 0·03 mm. diameter, i.e., 50:1 or 33:1. Of all Dicotyledons, *E. regnans* comes next to Conifers in the value of its wood for paper-making, and it has the advantage of being of more rapid growth than most Conifers.

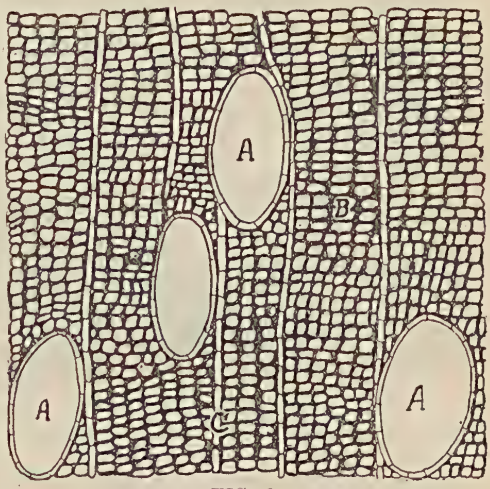

FIG. 8.

TRANSVERSE SECTION OF WOOD OF EUCALYPTUS REGNANS.

A, vessels. B, wood fibres. C, medullary rays.

In Conifer wood the fibres or tracheides serve both for conduction and as mechanical tissue. Hence they are usually longer (up to 3 mm. long in spruce) and thinner walled than those of Dicotyledons (up to 1 mm. long in Eucalypts, Poplars, Ash, &c.), so that, with a few exceptions, Conifer wood is superior for paper-making.

The wood developed in spring and summer has the wood fibres larger and with relatively thinner walls (Fig. 9—B), while those formed in autumn have smaller cavities and relatively thicker walls. The vessels are usually most abundant, or are only present in the spring wood. Occasionally in Eucalypts more than one ring may be formed in a year, and in the wood of the Moreton Bay Fig (*Ficus macrophylla*) several alternating layers of smaller thick-walled fibres (Fig. 10—C) and larger thinner-walled fibres (Fig. 10—B) may be formed in each year. Hence there may be 2 to 6 rings in a year's growth, and the number varies at the same level, there being more on a projecting buttress than where the growth has been less active.

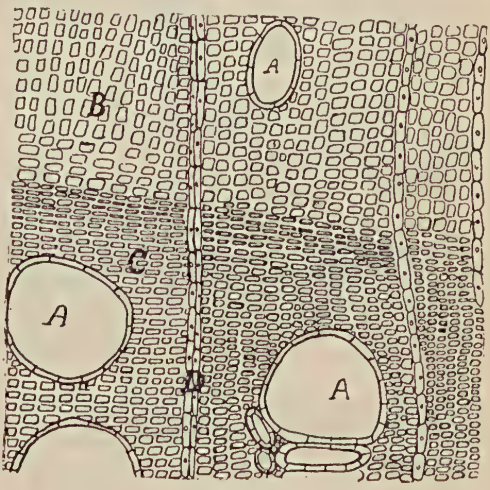

FIG. 9.

TRANSVERSE SECTION OF ACACIA WOOD.

A, vessels. B, wood fibres of spring wood. C, wood fibres of autumn wood. D, medullary ray.

The medullary rays are usually narrow in Eucalypts and Acacias (Figs. 7, 8, and 9), but are broader in the Moreton Bay Fig (Fig. 10—D), and still broader in the Oak (*Quercus*) (Fig. 11—C), in *Banksia*, and in *Casuarina*. The medullary rays remain living in the sap wood, and serve for the storage of food materials (starch, oil, &c.). Usually they form the first point at which decay begins, and in the Mountain Ash may remain in the wood of a standing tree as living cells for over a hundred years. In most trees they die and lose their food material more or less completely in the older heart-wood, and are then less liable to decay. In Casuarina in fact the large medullary rays become so lignified and indurated that they may be more resistant to decay than the wood fibres themselves. Occasionally the wood may contain parenchyma cells other than those present in the medullary ray (Fig. 11—D). In the English Oak the wood vessels (Fig. 11—B) are made up of short thick-walled segments, and do not decrease the strength of the wood as much as do the vessels of a Eucalypt (cf. Figs. 7 and 8). In the wood of *Drimys aromatica* there are no true vessels, unless their place is taken by short thick-walled pitted parenchyma cells (Fig. 12—BB), while the wood fibres are large and have bordered pits as in a Conifer (Fig. 12—AA). Wood of this type is, however, quite unusual in Dicotyledons.

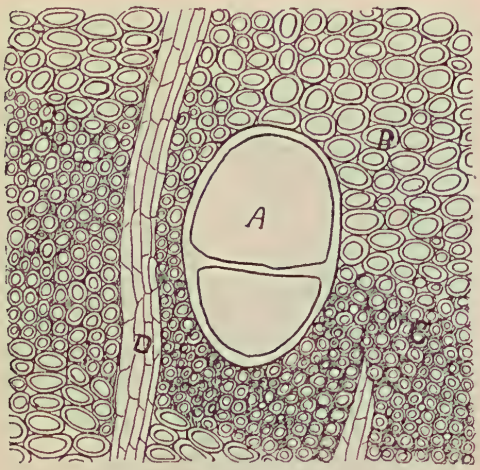

FIG. 10.
TRANSVERSE SECTION OF WOOD OF MORETON BAY FIG.
A, vessel (cut where the ends of two vessels meet). B and C, false annual rings. D, medullary ray

FIG. 11.
RADIAL LONGITUDINAL SECTION WOOD OF ENGLISH OAK (QUERCUS).
A, wood fibres. B, wood vessels. C, medullary ray. D, pith ray.

Although the physical properties of timber depend upon its structure and upon the character of the cells and cell-walls composing it, it may show considerable variations, according to the conditions under which it is grown. Thus when grown rapidly, wood is usually softer, more open grained, less tough and durable, and of lower density than when slowly

grown. The same difference applies as between timber of the same species grown on sandy soils (softer wood, &c.), as compared with that grown on heavy clay soils, or grown at the bottom of moist valleys, as compared with that grown on higher and more exposed and drier slopes. The differences between the timber of forest Redgum and of river Redgum are mainly due to the different localities in which the two varieties normally grow.

Even in the same genus the quality of the wood may vary greatly. Thus the Pines normally yield a soft not very strong or durable timber, but that of the Canary Pine (*Pinus canariensis*) and of the Pitch Pine (*P. rigida*) is very durable, and that of the long-leaf Pine (*P. palustris*), Pitch Pine (*P. rigida*), and Chir Pine (*P. longifolia*) is nearly as hard as that of such hard woods as Mountain Ash and Messmate.

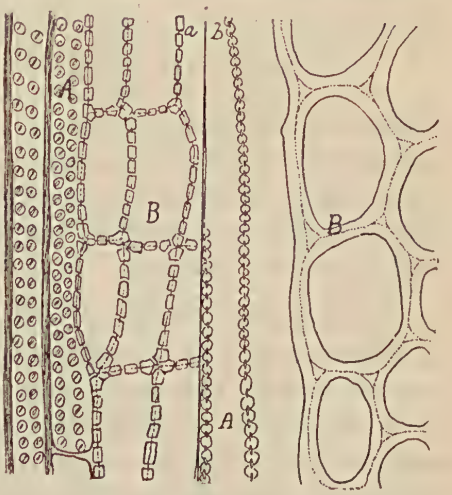

FIG. 12.
LONGITUDINAL SECTIONS OF WOOD OF DRIMYS AROMATICA.
a, radial; b, tangential. A, wood fibres with bordered pits. B, wood "Parenchyma."

THE SEASONING OF TIMBER.

No more convincing evidence could be obtained of the importance of using strictly defined terms than is afforded by the controversy which has raged so long in regard to "natural" versus "artificial" seasoning.

Natural seasoning is a process connected with the life of the tree, and is shown to a marked extent only by those trees which develop a well-marked duramen ("heart-wood"). In such cases, as the tree ages the original alburnum (sap-wood) of the young tree gradually alters centrally, the process involving (1) chemical alterations in the walls of the wood elements, often accompanied by a darkening or change of colour in the wood, (2) the death of the medullary ray cells, which is usually preceded by a removal of their starchy or oily food materials, (3) an increase in the durability, and in some cases in the hardness, density, and rigidity of the wood, whereas the strength is little affected, (4) a decrease in the percentage of moisture, so that in the standing tree the cavities and the walls of the sap-wood fibres normally contain more moisture than those of the heart-wood.

When a tree with pronounced heart-wood is felled and left lying with the bark on, the medullary rays in the outer layers of wood remain living for some time, and to a slight extent the process of natural seasoning continues. The gain in the value of the wood produced in this way is however, very slight, and is more than counterbalanced by the danger

from fire, insects, and fungi while the fallen trunk is slowly dying. No appreciable advantage is gained by this seasoning, unless the trunks are to be used for poles or beams unsawn. In a tree like the Mountain Ash (*E. regnans*), which develops no distinct heart-wood, the more rapidly its wood can be dried without warping or splitting the better. Indeed the core wood of an old Mountain Ash (wrongly called heart-wood by saw-millers) is often quite soft or punky, and may be wetter than the outer wood, simply as the result of long standing after the wood was ripe, and because the wood of the young up-drawn sapling is "etiolated" and imperfectly lignified.

When timber is to be sawn, the sooner it reaches the saw the better, and there is then no question of natural seasoning for two good reasons, namely, because it does not take place and because it is not natural for trees to be sawn up. It is then merely a question of whether it is more profitable to dry out the surplus moisture in the timber slowly by exposure to the air with variable conditions of temperature and humidity, or more rapidly with raised temperature and controlled humidity. Freshly-sawn timber contains about half its weight of water after any free water has drained out, and this absorbed water has to be reduced to about 10 or 15 per cent. by drying before the timber is fit for use.

In drying timber the only two conditions of importance are (1) that the rate at which the wood dries at the surface shall not at any time much exceed the rate at which water diffuses to the surface from deeper layers, so that the drying is uniform, (2) that as all timber contracts on drying, the fibres shall have time to adjust themselves uniformly, so as to avoid setting up internal stresses which either warp the timber or overcome the cohesion of the fibres and cause cracking.

The moisture diffuses more rapidly radially than tangentially, so that drying is more rapid on a tangential than on a radial surface, and the tangential shrinkage is usually twice as great as the radial. Hence timber sawn on the quarter has a less tendency to warp than tangentially cut planks whose outer and inner layers have very different rates of drying.

Tiemann has suggested that the excessive shrinkage of certain timbers may be due to an actual collapse of the walls of the wood fibres more or less obliterating their cavities, and that this may be due to the cohesion of the water columns which they enclose, drawing in their walls as the water evaporates. This would be an analogous action to that involved in Dixon and Joly's theory of the ascent of sap, and involves similar difficulties in its acceptance. Firstly, the existence of a high cohesion tension of water has not been demonstrated by direct experiment in either the living tree or in drying wood, and it can only be produced in the absence of air and in vessels impermeable to air. Secondly, all fibres have thin places in their walls, and these would give way before the fibre as a whole collapsed. Thirdly, the fibres in living and in dead

wood may be repeatedly filled with water and emptied without collapsing, air or water vapour replacing their liquid contents. Fourthly, in lignite and fossil wood, which has been subjected to great pressure for millions of years, the cavities of the fibres may be retained or gradually filled up by infiltration without the fibres showing any signs of collapse.

In many eucalypt timbers the vessels are very large and thin walled, and may be surrounded by parenchyma cells. Here a partial collapse of the cavity is possible, apart from the contraction due to loss of water of imbibition, although the cavities are never obliterated. A similar collapse is also possible in the medullary ray cells, but the wood fibres are the least likely elements of the wood to show such collapse.

Soft mountain ash timber may show excessive and irregular shrinkage if rapidly dried, but, if then steamed, may re-expand to the original size and, if slowly dried, show regular even shrinkage. If rapidly dried it may, however, show even greater collapse than before, although the steaming does not introduce any liquid water into the vessels or fibres which were emptied by the previous drying. No contraction of liquid water columns can therefore come into play.

Hence until definite evidence of it is brought forward, one must hesitate to accept Tiemann's explanation of the readiness with which certain timbers contract excessively on drying.

If the substance of timber was a homogeneous colloidal solid throughout, the rate at which moisture would diffuse to the surface would be proportional to the square of the distance from the surface, i.e., to the square of the radius in the case of a cylinder or to the square of half the side in the case of a rectangle. The porous character of wood appears, however, to increase the rate of diffusion to the surface. Thus 5-in. x 5-in. rectangles of Redgum after three years' air drying contained 15 per cent. to 16 per cent. of water, i.e., were seasoned, whereas 10-in. x 10-in. rectangles after six years contained 27 per cent. to 30 per cent of water, but were fully seasoned after nine years' air drying instead of requiring twelve years. Similarly a 2-in. plank of Mountain Ash required only three (instead of four, i.e., two, squared) times as long to season as a 1-in. plank, and an 8-in. x 8-in. beam took only three times as long as a 4-in. x 4-in. beam to season instead of four times as long.

The rate at which moisture diffuses to the surface increases as the temperature rises, and the wood fibres adjust themselves more rapidly and readily when drying wood is warm than when it is cold. At the same time the rate of evaporation from the surface increases very greatly as the temperature rises, but if the surrounding air is kept moderately humid, the drying is kept at the proper ratio to the rate of diffusion to the surface. Hence in the warm air of a kiln, wood can be dried very rapidy without suffering in any way, provided that the above guiding principles are satisfied.

Steaming green wood, i.e., placing the wood in 100°C. steam for some hours, softens the walls of the wood fibres and loosens their cohesion, so that a fixed curvature can be given to it on drying, as in the crook of a walking stick. In some cases of timber with checks or shakes, steaming followed by slow drying may remove the cracks, but if the drying is rapid they will increase. With some timbers, the softening of the walls of the wood fibres makes them contract more than usual on drying, so that the steamed wood may shrink more on drying than wood which has not been steamed. Since the steaming does not increase the subsequent rate of drying in air, there is nothing to be gained by subjecting sawn timber to this process. Quickly dried steamed wood may be slightly harder when dry than unsteamed dry timber, but if slowly dried the grain may be freer, so that the wood works more easily.

THE ECONOMIC PROPERTIES OF NATIVE TIMBERS.

Data in regard to economic properties are given under each species and as far as possible the data are comparative. Where not otherwise specified the data given are for timber in the air dry condition, i.e., with 12 per cent. to 15 per cent. of water (weight of a cubic foot, tests of strength &c.). Green wood may have 30 per cent. to 50 per cent less strength than when seasoned. Air dry timber in Melbourne contains on the average 15 per cent. of water throughout the year, the percentage decreasing slightly in summer and increasing slightly in winter if the timber has a large exposed surface. To find the weight of a cubic foot of timber when its air dry weight (15 per cent. water) is known, multiply the weight in pounds by 100, substract the weight of 15 cubic feet of water (15 x 62·5) and divide by 85. To find the percentage of water in a block multiply the difference between the weight of an air dry (15 per cent.) cubic foot and of an absolutely dry cubic foot by fifteen and divide by the difference between the weight of a cubic foot of the block itself and of an absolutely dry cubic foot.

In regard to the important qualities of strength and hardness, both increase as the wood is dried. Perhaps the best idea of the strengths and hardness of our native hardwoods is given by comparison with a few well known hardwoods, such as oak, varieties of Teak (*Djatti*) and Lignum Vitae.

Timber.	Comparative Transverse Strength.	Comparative Hardness.
E. globulus	150	3.8
E. regnans	128	2.7
E. obliqua	156	3.2
E. rostrata	96	4.5
E. paniculata	185	7.4
E. crebra	185	7.4
E. hemiphloia	150	6.8
English Oak	120	3.6
American Oak	85	3.5
Oregon Pine	70	1
Djatti	130	3
Lignum Vitae	120	6.6

In the general text the transverse breaking stress is the load in pounds required to break a beam of the given dimensions with the load at the middle and supported at the ends.

Bluegum and Messmate are about as hard as English Oak but are stronger. Mountain Ash is as strong as English Oak but is softer and more easily worked. Finally the wood of Grey Box and Ironbark is both stronger and harder than Lignum Vitae.

REPRODUCTION.

Reproduction by Seed.—Many Eucalypts may produce fertile seed when five years old if grown in open exposed localities, whereas under the shade of a forest canopy seeding may be delayed for 20 or more years. Most Pines do not seed heavily until about 20 years old, and if closely planted, often not until 30 or 40 years, though Aleppo Pine may seed when five or six years old. Seeding is usually more abundant in certain years, but in some districts a Eucalypt may flower and seed freely in one year, while in other districts none are to be found until the year following. Trees may continue to seed when hundreds of years old. Fertile seed from aged trees produces normal seedlings except that in some cases the seedlings appear to mature and seed a little earlier than usual. Seedlings derived from Eucalyptus seed over 30 years old, and from Acacia seed over 60 years old did not, however, differ appreciably in character from those derived from fresh seed of the same species. In regard to the longevity of seeds and their duration in the soil, details are given in the general text under the different genera.

Reproduction by Sprouts.—In the case of most Eucalypt trees when cut down, the stumps, if not too old, send up new shoots, which grow very rapidly and soon form a dense mass of *coppice*. There does not appear to be any noticeable and constant difference between the wood from coppice shoots and seedlings and shoots of the same species if grown under equivalent conditions of moisture, temperature and light.

A few Conifers (Canary Island Pine, Redwood, &c.) will sprout from the butt, but usually the sprouts do not attain a large size. In the Redwoods (*Sequoia*) they grow sufficiently well to form marketable timber.

Reproduction by Suckers.—These are shoots formed from the underground roots, as in the Poplar, Elm and *Robinia*. Reproduction by suckers is of little practical importance in forestry and is a nuisance in gardens, avenues and plantations.

Where peppermint scrub has been frequently burnt, the new shoots form at the surface of the ground or beneath it and gradually a gnarled, more or less horizontal root butt, mostly buried in the soil and somewhat resembling mallee " roots," is formed. Ground covered by them is very difficult to clear, but the butts form fairly good firewood.

When the top of a tree is killed by fire, drought or disease, the trunk often breaks out into short " epicornic " branches. Such trees, if not soon felled, become useless, since all the new wood is full of knots and the central wood rots away. The ground they cover in a forest represents so much waste space.

In many species of Eucalyptus, the young seedlings often develop at their bases rounded tubercles sometimes an inch or more in diameter but usually much smaller. These contain a large amount of woody cells containing starch and aleurone grains. They appear not to be due to infection by a foreign organism, as in the root tubercles of *Leguminosae*, but to be temporary storage reservoirs of food material, termed " lignotubers ", according to the observations of Miss L. R. Kerr (Roy. Soc. Vict. 1925). They appear on the seedlings early in *E. melliodora* and *E. elaeophora*, but at a later stage in *E. globulus*. Although usually at the ground level they may develop higher up and there may be more than one present. Few seedlings of *E. globulus*, *E. pauciflora*, *E. ficifolia*, and *E. polyanthemos* remain without lignotubers, but in *E. melliodora* and *E. elaeophora* a large proportion or even the majority of the seedlings may be without them. The lignotubers aid seedlings to survive injury or temporary drought.

If the main shoot is damaged, frequently the surface of the lignotuber breaks out into a mass of small shoots spoiling the early development of the tree or giving rise to a kind of coppice growth from an irregular butt, but in other cases one shoot masters the others and a single stem ultimately is formed. The coppice growth is encouraged by exposure and single shoot growth by shade.

DICHOTOMOUS KEY FOR THE IDENTIFICATION OF VICTORIAN SPECIES.

Plants parasitic on other plants, without any rooted attachment to the soil .. .. *A*

Plants not parasitic or with a definite root system .. .. *B*

A.—Plants with distinct green leaves. XXXVII. *Loranthus.*

Plants with the leaves reduced to minute scales, and green twining or straggling stems. LIII. *Cassytha.*

B.—Plants without distinct flowers and not forming fruits (Tree Ferns) 1

Plants without distinct flowers but forming fruits, usually hard and woody cones (Gymnosperms) 5

Plants with distinct flowers.. .. .. *a, b, c*

(*a*) Flowers in dense heads resembling single flowers, and usually closely surrounded by green parts or bracts (*Compositæ*) 7

(*b*) Flowers in dense rounded elongated or cone-like clusters, small, but distinct when closely examined and with free anthers, the clusters not or not closely surrounded by green or coloured parts (Grass trees, Sheokes, Acacia, Pimelea, Banksia) 12

(*c*) Individual flowers quite distinct, though often closely crowded and small 48

(1) Tree Ferns—

Trunks short and stout, under 5 feet high, usually growing in groups. III. *Todea barbara.*

Trunks tall, attaining over 5 feet, unbranched, growing singly from the ground 2

(2) Sporangia with nearly vertical annulus, indusium split in two. Sorus enclosed by two membranous valves. I. *Dicksonia antarctica.*

Sporangia with an oblique annulus 3

(3) Sorus with a cuplike indusium 4

Sorus with no indusium. II. *Alsophila australis.*

(4) Plant darker and frond stouter. IV. *Cyathea medullaris.*

Frond paler and pinnules thinner. III. *Cyathea Cunninghami.*

(5) Alpine plant rarely more than a shrub. VIII. *Podocarpus alpina.*

Segments of the fruit cone not furrowed at their junctions. VI. *Callitris robusta.*

Segments furrowed at their junctions 6

(6) The inner larger segments of the fruit swollen apically, the dorsal point on their backs. VII. *Callitris cupressiformis.*

The inner larger valves hardly dilated apically, the dorsal point near their tips. VIII. *Callitris calcarata.*

(7) Leaves large and broad, covered beneath by dense white wool. CCXXVIII. *Bedfordia salicina.*

Leaves small or of medium size, not at all or only moderately woolly beneath 8

(8) Flower heads small, in dense clusters, each head with white or brown bracts but with no spreading petal-like rays 9

Flower heads larger in less compact clusters, and with spreading petal-like rays 11

(9) Leaves very narrow, with short rigid hairs. CCXXVI. *Cassinia aculeata.*

Leaves nearly linear, but broader and with a distinct lamina .. 10

(10) Bracts round the flower heads mostly white and opaque. CCXXVII. *Cassinia longifolia.*

Bracts scarious, pale brown and nearly transparent. CCXXV. *Helichrysum ferrugineum.*

(11) Leaves very narrow and linear. CCXXIV. *Olearia glandulosa.*

Leaves much broader and more or less rounded or ovate. CCXXIII. *Olearia stellulata.*

Leaves 3.5 inches long, and plant with a musky smell. CCXXII. *Olearia argophylla.*

(12) Stem short, stout, with a rosette of long linear grass-like leaves and a tall spike when flowering (Grass trees) 13

Plants with a tree-like habit 14

(13) Leaf bases with a reddish resin. XI. *Xanthorrhoea australis.*

Leaves bases with a paler yellowish resin. XII. *Xanthorrhoea hastilis.*

(14) Flower heads partly enclosed by a few prominent bracts .. 15

Flower heads without prominent bracts at least when fully expanded 10

(15) Flower heads axillary. CXV. *Pimelea axiflora.*

Flower heads terminal. CXVI. *Pimelea microcephala.*

(16) Fruit hard, woody and cone-like 17

Fruit a flattened or curved pod (legume) 23

(17) Fruit more than 2 inches long 18

Fruit less than 2 inches long 26

(18) Leaves pointed apically. XXXVI. *Banksia integrifolia.*

Leaves with more or less flattened apices 19

(19) Leaves entire or slightly denticulate. XXXVII. *Banksia marginata.*

Leaves regularly serrate. XXXV. *Banksia serrata.*

(20) Usually under 10 feet to 20 feet in height. XIII. *Casuarina distyla.*

Usually over 20 feet when full grown 21

(21) Branchlets drooping. XVII. *Casuarina stricta.*

Branchlets more or less erect 22

(22) Leaf teeth about 5 to 6 in the sheath. XVIII. *Casuarina suberosa.*

Leaf teeth more than 6, usually 9 to 12 .. .. .. 22A

(22A) Cones up to an inch in diameter. XV. *Casuarina lepidophloia.*

Cones usually half an inch in diameter 22B

(22B) Bark furrowed ; seeds brown. XVI. *Casuarina Luehmanni.*

Bark more flaky ; seeds grey. XIV. *Casuarina glauca.*

(23) Leaves compound, divided into leaflets 24

Leaves replaced by undivided phyllodia (flattened leaf stalks) or more or less leaf-like branches 26

(24) Leaflets very small and numerous 25

Leaflets fewer and larger, each averaging 1 cm. long by 3 to 4 mm. broad. LXXXVIII. *Acacia discolor.*

(25) Leaflets and whole tree with a silvery sheen. XCI. *Acacia dealbata.*

Foliage green, flowering early. LXXXIX. *Acacia decurrens.*

Foliage changing from yellowish to greyish and darkening later, flowering late. XC. *Acacia mollissima.*

(26) Flowers in globular heads 33

Flowers in more or less elongated racemes or spikes 27

(27) " Leaves " (phyllodes) with sharp points 28

Phyllodes not prickly, without sharp points 29

(28) Phyllodes flat and fairly large. LXXX. *Acacia oxycedrus.*

Phyllodes small; narrow and in whorls. LXXXI. *Acacia verticillata.*

(29) Phyllodes over a centimetre broad 30

Phyllodes less than a centimetre broad 31

(30) Pods strongly contracted between the seeds. LXXXII. *Acacia Dallachiana.*

Pods not strongly contracted between the seeds with blunt ends. LXXXVII. *Acacia glaucescens.*

Pods not strongly contracted between the seeds with pointed ends. LXXXIII. *Acacia longifolia.*

(*Acacia longifolia* var. *floribunda* may have the phyllodes barely or less than a centimetre broad.)

(31) Phyllodes very narrow, thick, and more or less rounded. LXXXV. *Acacia aneura.*

Phyllodes long but flattened 32

(32) Phyllodes, with prominent longitudinal veins. LXXXIV. *Acacia linearis.*

Phyllodes, with very fine closely set veins on each side of the midrib, but not prominent. LXXXVI. *Acacia doratoxylon.*

(33) Phyllodes very narrow, linear, and needle-like 34

Phyllodes flattened 35

(34) Phyllodes rounded, very rigid, but with rather blunt points. LX. *Acacia rigens.*

Phyllodes slightly flattened with hooked points. LXI. *Acacia calamifolia.*

(35) Phyllodes, with two prominent longitudinal veins 36

Phyllodes, with one prominent longitudinal vein and occasionally a second less prominent one 37

Phyllodes, with more than two prominent longitudinal veins at least in the broader phyllodes* 44

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* *Acacia subporosa* var. *linearis* often has only the median longitudinal vein prominent.

(36) Phyllodes narrow, lanceolate, longer than broad. LXII. *Acacia verniciflua.*

Phyllodes rounded, triangular, as broad as long. LXXII. *Acacia pravissima.*

(37) Phyllodes with a sharp point at the tip, sometimes very small .. 38
Phyllodes without a sharp point at the tip 41

(38) Phyllodes more than four times as long as broad, often very long and narrow 39
Phyllodes less than four times as long as broad 40

(39) Lateral veins not prominent, surface more or less shining, with a sticky secretion. LXIII. *Acacia leprosa.*

Surface dull, lateral veins parallel and obliquely divergent. LXVI. *Acacia retinodes.*

Surface dull, lateral veins irregular or reticulate. LXIX. *Acacia salicina.*

(40) Phyllodes with a prominently thickened margin. LXXIII. *Acacia myrtifolia.*

Phyllodes with a distinct margin, but not very prominent. LXXI. *Acacia brachybotrya.*

Phyllodes without any prominent margin. LXX. *Acacia buxifolia.*

(41) Phyllodes straight or nearly so 42
Phyllodes large and usually strongly curved 43

(42) Phyllodes small, usually under 2 cms. long; fruit large, broad, and flat. LXIV. *Acacia sentis.*

Phyllodes of medium size, rather narrow, and 5 to 8 cms. long. Fruit narrow and constricted. LXVIII. *Acacia hakeoides.*

(43) Phyllodes with the main vein central or nearly so. LXVII. *Acacia pycnantha.*

Phyllodes with the main vein in most of the phyllodes much nearer one side. LXIV. *Acacia penninervis.*

(44) Phyllodes broad, often more than 2 cms. broad. LXXVIII. *Acacia melanoxylon.*

Phyllodes very narrow, sometimes over a foot long. LXXVII. *Acacia stenophylla.*

Phyllodes neither extremely broad nor extremely long 45

(45) Phyllodes mostly over 8 cms. long 46
Phyllodes less than 8 cms. long 47

(46) Phyllodes usually strongly curved, with a blunt point. LXXIX. *Acacia implexa.*

Phyllodes mostly straight or nearly so, tapering to a soft point or very narrow. LXXIV. *Acacia subporosa.*

(47) Phyllodes rigid, with a sharp curved point at the tip; fruit over half a cm. broad. LXXVI. *Acacia Osswaldii.*

Phyllodes less rigid, the curved apical hook less developed or absent; fruit narrow, under half a cm. broad. LXXV. *Acacia homalophylla.*

(48) Shrubs or small trees growing on muddy sea shores partially submerged at high tide. CCXI. *Avicennia officinalis.*

Inland or coastal plants growing above the tide marks .. 49

(49) Palm-like stem, with a terminal rosette of large fan-shaped leaves more than a foot broad. X. *Livistona australis.*

Tree-like stems, with small or moderate sized leaves rarely a foot or more long, but never over a foot broad 50

(50) Stamens numerous, at least more than ten 51

Stamens ten or fewer 195

(51) All or most of the flowers hermaphrodite, with stamens and carpels together 57

Flowers male and female, the stamens and carpels separate .. 52

(52) Carpels few, three or so united in a single ovary 53

Carpels five, fruitlets long and pod-like opening along one side. CXII. *Brachychiton populneus.*

Carpels numerous, ten to twenty or more 56

(53) Fruits splitting into two or three valves. XCVIII. *Bertya Findlayi.*

Fruit usually splitting into six valves 54

(54) Petals present. XCVII. *Beyeria viscosa.*

Petals absent or rudimentary 55

(55) Sepals usually three. XCIV. *Claoxylon australe.*

Sepals more than three. XCV. *Adriana quadripartita.*

(56) Fruitlets coherent into an almost bell-shaped fruit. XLVIII. *Codonocarpus cotinifolius.*

Fruitlets enclosed in a cup-shaped fruiting calyx. LII. *Atherosperma moschatum.*

Fruiting calyx expanded with the fruitlets exposed. LI. *Hedycarya angustifolia.*

(57) Stamens united at least at the base to form a column around the styles 58

Stamens not forming a coherent column 59

(58) Stamens united at the base only, forming a short column. C. *Howittia trilocularis.*

Stamens forming a long column splitting at the top into several filaments. CIX. *Plagianthus pulchellus.*

(59) Fruit globular or lobed and more or less berry like 61

Fruit dry or capsular, but not berry like 60

(60) Flowers solitary, fruit urn shaped, staminodia shorter than the stamens. L. *Eupomatia laurina.*

Flowers usually several together, staminodia rarely present, and then usually as long as the fertile stamens 64

(61) Fruit large, up to 2 inches in diameter. LIV. *Capparis Mitchelli.*

Fruit small, usually under 1 inch in diameter 62

(62) Carpels single, or rarely two or three, but then not united, and each forming a globular berry the size of a pea. XLIX. *Drimys aromatica.*

Ovary of three or four united carpels, forming a fruit with one or two, rarely three or four, lobes. CL. *Heterodendron oleaefolium.*

Ovary of two united carpels forming a globular or ovoid drupe .. 63

Ovary of two united carpels forming a rosy-white succulent berry. CXIX. *Eugenia Smithii.*

(63) Fruit blue. CVII. *Elaeocarpus cyaneus.*
Fruit black. CVIII. *Elaeocarpus holopetalus.*

(64) Flower bud with an operculum falling when the flower expands and leaving it without petals .. .. .. 81 and 132
Flowers with petals 65

(65) Stamens usually shorter than the petals and alternating with them, either free or united in bundles 66
Stamens longer than the petals and opposite to them, either singly or united in bundles ; leaves usually small and flowers usually large or sessile on the stem 69
Stamens numerous, in a continuous ring ; leaves usually large, flowers in umbels, heads or cymes 80
Stamens united in bundles of fifteen to twenty, inflexed and barely exceeding the petals ; capsule projecting beyond the calyx tube. CXVIII. *Tristania laurina.*

(66) Ovary usually six to ten celled. CLXXXV. *Leptospermum laevigatum.*
Ovary four to five celled 67

(67) Calyx not hairy. CLXXXVI. *Leptospermum flavescens.*
Calyx silky or hairy 68

(68) Flowers without distinct stalks. CLXXXVII. *Leptospermum lanigerum.*
Flowers with distinct stalks. CLXXXVIII. *Leptospermum attenuatum.*

(69) Stamens free 70
Stamens in five bundles opposite the petals 76

(70) Calyx lobes usually persistent, ovary two to five celled, flowers in heads or solitary, rarely in short spikes
Calyx lobes usually deciduous, ovary three to four celled .. 71

(71) Flowers in spikes, the apices of which may continue to grow .. 72
Flowers small, shortly stalked, stamens in one ring. CLXXXIX. *Kunzea peduncularis.*
Flowers white, nearly sessile, stamens in two or three rings. CXC. *Kunzea corifolia.*

(72) Stamens red (wholly or in part) 73
Stamens yellow or greenish yellow 74

(73) Filaments and anthers red. CXCI. *Callistemon lanceolatus.*
Filaments red, anthers yellow. *Callistemon coccineus.*

(74) Leaves showing transparent dots against the light. CXCIII. *Callistemon salignus.*
Leaves not showing distinct transparent dots when dry, although glandular 75

(75) Leaves small, narrow, linear, and thick. CXCIV. *Callistemon Sieberi.*
Leaves over 3 cms. long, lanceolate or linear lanceolate. CXCV. *Callistemon paludosus.*

(76) Leaves mostly in opposite pairs 77
Leaves not in opposite pairs, though often crowded 78

(77) Leaves one to three nerved. CXCVI. *Melaleuca decussata.*
Leaves five to seven nerved. CC. *Melaleuca squarrosa.*

(78) Leaves usually with curved points at the tip. CXCVII. *Melaleuca armillaris.*
Leaves with blunt tips or straight points 79

(79) At least the young shoots distinctly hairy, about seven stamens in each bundle. CXCIX. *Melaleuca parviflora.*
Plants with few or no hairs ; at least ten stamens in each bundle. CXCVIII. *Melaleuca ericifolia.*

(80) Petals five, calyx with five small teeth. CXX. *Angophora intermedia.*
Petals four, small, calyx with petal-like lobes. *Backhousia myrtifolia.*

EUCALYPTUS.

(Identification from buds, fruits, and leaves in absence of flowers.)
For key when flowers are present see (132) and special text.

(81) Fruit valves completely sunk in the capsule 83
Fruit valves completely sunk, but usually four small points showing nearly at the level of the broad reddish rim 82
Fruit valves projecting, or the points reaching the rim,* or if below the rim, the latter not broad and reddish 105
Fruit valves barely reaching the rim, fruits shining, sessile in a dense cluster of five to eight ; leaves long and narrow. CXXVI. *E. nitens.*

(82) Leaves thick, mostly over 2 cms. broad. CLXXXI. *E. Considineana.*
Leaves rather thin, mostly less than 2 cms. broad. CLXXVIII. *E. vitrea.*

(83) Flower buds in irregular clusters, the terminations usually umbellate 84
Flower buds in simple umbels 91
Flower buds in irregular clusters or in simple umbels ; leaves very round or slightly pointed ; capsule small, with a thin rim. CLIII. *E. Baueriana.*

(84) Leaf surfaces equally green 85
Lower surface paler than upper 90

(85) Fruit at least one-third of an inch diameter and more or less urceolate. CXXXIX. *E. maculata.*
Fruit rarely exceeding $\frac{1}{4}$ inch in diameter 86

(86) Leaves orbicular to ovate. CLII. *E. polyanthemos.*
Leaves lanceolate falcate to ovate lanceolate 87

(87) Operculum conical 88
Operculum hemispherical, rarely slightly conical 89

(88) Fruit, including the stalk, 1 cm. long. CLVI. *E. hemiphloia.*
Fruit, including the stalk, under 1 cm. long ; operculum short. CL. *E. fasciculosa.*

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* In old capsules, particularly of *E. goniocalyx* and *E. elaeophora*, the points of the valves may be overtopped by the rim of the capsule, but the rim is then not broad and reddish as in *E. haemastoma* and similar forms.

(89) Leaves ovate lanceolate. CLV. *E. Behriana.*
Leaves lanceolate. CXLIX. *E. bicolor.*

(90) Capsule urceolate. CXXVIII. *E. corymbosa.*
Capsule ovate or rounded truncate. CLXX. *E. paniculata.*

(91) Base of operculum projecting beyond the rim of the calyx. CXXXI. *E. cladocalyx.*
Operculum not broader than the calyx 92

(92) Leaves with several longitudinal veins almost parallel with the midrib 93
Leaves with the veins more or less divergent from the midrib .. 94

(93) Operculum conical, leaves rather small. CLXI. *E. stellulata.*
Operculum hemispherical, leaves large. CLXXXII. *E. pauciflora.*

(94) Pedicels elongated 95
Pedicels short or none 98

(95) Fruits under $\frac{1}{4}$-in. diameter; flowers numerous in radiating clusters. CLXXIX. *E. radiata.*
Fruits under $\frac{1}{4}$-in. diameter; flowers few or in irregular clusters. CLXXI. *E. melliodora.*
Fruits over $\frac{1}{4}$-in. diameter 96

(96) Leaf veins slanting more towards the edge of the leaf. CXXIII. *E. longifolia.*
Leaf veins slanting more towards the apex of the leaf 97

(97) Fruits contracted towards the rim; bark dark, hard, and rugged; wood red. CLXXII. *E. sideroxylon.*†
Fruits hardly contracted towards the rim; bark, smooth, blue or white, wood yellow or pale. CLXXIII. *E. leucoxylon.*

(98) Capsule contracted at the mouth, nearly globular. CLXXVI. *E. piperita.*
Capsule slightly or not at all contracted‡ .. .. ..

(99) Peduncles short and thick, usually much flattened. CXXIX. *E. incrassata.*
Peduncles rounded and usually slender 100

(100) Calyx angular 101
Calyx rounded 102

(101) Fruits, small, about $\frac{1}{4}$ inch long, nearly hemispherical. CLVIII. *E. polybractea.*
Fruits more elongated (about $\frac{1}{2}$ inch long). CLI. *E. calycogona.*

(102) Calyx and operculum, granular or rough. CLXXIV. *E. obliqua.*
Calyx and operculum, smooth 103

(103) Fruit usually five or six celled. CLIV. *E. Bosistoana.*
Fruits mostly four celled 104

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† It is still doubtful whether *E. sideroxylon* is more than a variety of leucoxylon. The flowers are identical, the difference in the fruits is not always constant, while the bark and colour of the wood vary in other species of eucalyptus.

‡ Sometimes (*E. melliodora, E. amygdalina,* &c.) the rim of the capsule has a thin, brown, shrivelled membrane or ring, more or less deciduous and contracting the orifice or doming the capsule. It is easily broken away, does not grow with the capsule, but is often prominent and persistent in dry seasons, and may so contract the orifice as to hinder the dispersal of the seeds.

(104) Fruit more ovate. CLIX. *E. odorata.*
Fruit more globular. CLXXI. *E. melliodora.*

Fruits more pear shaped, leaves usually large, with abundant oil dots. CLXXX. *E. gigantea.*

Fruits more pear shaped, leaves narrow, oil dots rather large. CLX. *E. viridis.*

(105) Leaves paler beneath 106
Leaves equally green on both sides 108

(106) Thalamus tube, angular. CXXIV. *E. botryoides.*
Thalamus tube, rounded 107

(107) Fruits under $\frac{1}{4}$-in. diameter. CXLIII. *E. Bridgesiana.*
Fruits over $\frac{1}{4}$-in. diameter. CLXXVII. *E. pilularis.*

(108) Leaves mostly opposite 109
Leaves scattered singly 111

(109) Leaves connate. CXXXV. *E. Perriniana.*
Leaves not connate 110

(110) Fruits stalked. CXXXVII. *E. cinerea.*

Fruits in sessile clusters, usually in the axils of the leaves. CXXXII. *E. neglecta.*

(111) Thalamus tube and operculum, warty. CXXI. *E. globulus.*
Thalamus tube and operculum, smooth or rough, but not warty.. 112

(112) Thalamus tube, angular, pedicels flattened. CXXV. *E. goniocalyx.*

Thalamus tube, rounded, pedicels short or absent, peduncle flattened 113

Thalamus tube and pedicels, rounded 114

(113) Leaves under 4 inches long. CXXXVI. *E. Kitsoniana.*
Leaves over 4 inches long. CXXVII. *E. elaeophora.*

(114) Fruit valves ending in fine points. CXXX. *E. oleosa.*

Fruit valves mostly ending in short blunt points. CXLV. *E. rubida.*

Fruit valves, short, sometimes angular 115

(115) Capsule depressed below the rim of the thalamus tube or on a level with it 116

Capsule raised above the rim of the thalamus tube 123

(116) Veins in the leaf, fine, numerous, very divergent. CLVII. *E. uncinata.*

Veins not numerous and very oblique 117

(117) Leaves less than 3 inches long. CXXXIV. *E. Gunnii.*

Leaves mostly more than 3 inches long 119

Leaves of intermediate length ; buds, flowers, and fruits funnel shaped, with straight sides 118

(118) Fruits over 6 mm. diameter. CXL. *E. ovata.*
Fruits under 6 mm. diameter. CXXXIII. *E. camphora.*

(119) Rim of fruit narrow, the valves slightly depressed. CXLVIII. *E. eugenioides.*

Rim of fruit broad but erect, the valves slightly projecting. CXLVIII. *E. maculosa.*

Rim of fruit broad and flat 120

(120) Leaves pale, bark hard and rugged. CLXXXIV. *E. Sieberiana.*
Leaves green, bark smooth or fibrous 121

(121) Fruit ovate, truncate, its top reddish. CLXIX. *E. haemastoma.*
Fruit globose, truncate or shortly ovate 122

(122) Leaves rather small, with few but large oil dots; bark fibrous. CLXIII. *E. amygdalina.*
Leaves large, oil dots small but numerous; bark fibrous at the base only. CLXXXIII. *E. regnans.*

(123) Leaves, small, thick, nearly symmetrical. CLXXV. *E. santalifolia.*
Leaves mostly large and inequilateral 124

(124) Seedling stems and young shoots quadrangular with opposite ovate bluish-white leaves. CXXII. *E. Maidenii.*
Young stems rounded 125

(125) Leaf veins very oblique 126
Leaf veins very divergent 129

(126) Flowers and fruits sessile. CLXV. *E. capitellata.*
Flowers and fruits on short pedicels 127

(127) Operculum conical 128
Operculum hemispherical. CLXVII. *E. Muelleriana.*

(128) Capsule 1 cm. broad and broader than long. CLXIV. *E. macrorrhyncha.*
Capsule of half the size and not quite as broad as long. CXLI. *E. Smithii.*

(129) Flowers mostly three in an umbel. CXLIV. *E. viminalis.*
Flowers more than three in each umbel 130

(130) Operculum from hemispherical to bluntly conical. CXLII. *E. Stuartiana.*
Operculum conical or pointed 131

(131) Operculum usually tapering to a beak. CXLVII. *E. tereticornis* var. *rostrata.*
Operculum conical, not beaked. CXLVI. *E. tereticornis.*

EUCALYPTUS.

Identification key when flowers are present.

(132) The outer stamens with small anthers or with small aborted ones.. 133
All the stamens fertile with normal anthers 138

(133) Umbels all axillary or lateral 134
Upper umbels in an irregular terminal cluster 136

(134) Flowers small. CLXXI. *E. melliodora.*
Flowers large 135

(135) Wood white or pale yellow. CLXXIII. *E. leucoxylon.*
Wood red. CLXXII. *E. sideroxylon.*

(136) Buds obovoid 137
Buds narrow and elongated; leaves thick; fruit with a broad flat red rim. CLXIX. *E. haemastoma.*

(137) Leaves rather thin; flowers small. CXLIX. *E. bicolor.*
Leaves rather thick; flowers medium to large. CLXX. *E. paniculata.*

(138) Anthers kidney shaped or broad and flat, the cells united at the top, divergent at the base 139

Anthers more or less globular, the cells distinct, opening in circular pores or small oblong slits 155

Anthers oblong or globose, the cells distinct, parallel and opening longitudinally 175

(139) Leaves with several veins running parallel from base to apex of leaf 140

Leaves with a distinct midrib from which the lateral veins arise more or less obliquely 141

(140) Flowers and fruit small, the latter not much exceeding $\frac{1}{8}$ inch diameter. CLXI. *E. stellulata.*

Flowers and fruit larger, the latter with a broad red rim and at least $\frac{1}{4}$ inch diameter. CLXXXII. *E. pauciflora.*

(141) The basal lateral veins of the leaf inserted very obliquely and extending nearly parallel to the midrib for at least two-thirds the length of the leaf 143

None of the lateral veins (excepting the marginal veins when present) extending as much as two-thirds the length of the leaf, but diverging from midrib to edge of leaf 145

The basal veins inserted very obliquely, but extending more than half the length of the leaf 142

(142) All the lateral veins obliquely set and not very prominent. CLXXXIV. *E. Sieberiana*

The upper lateral veins more divergent, the lower ones more oblique and all more prominent. CLXIII. *E. amygdalina.*

(143) Leaves under 4 inches long and rather thin. CLXXVIII. *E. vitrea.*

Many of leaves over 4 inches long or rather thick 144

(144) Calyx of flower much narrower towards the base. CLXXXIII. *E. regnans.*

Flower larger and calyx broad at the base. CLXII. *E. dives.*

(145) Capsules distinctly broader than long 146

Capsules not broader than long (excluding the stalk) 151

(146) Capsule of the hemispherical type, broadest at the top .. 148

Capsule of the globose type, narrowed at the mouth 147

(147) Rim of capsule narrow. CLXVIII. *E. eugenioides.*

Rim of capsule very broad and swollen, and projecting far above the rim of the calyx. CLXIV. *E. macrorrhyncha.*

(148) The top of the capsule flat 149

The top or edges of the capsule rounded 150

(149) Leaves broad ; carpels usually three. CLXVII. *E. Muelleriana.*

Leaves narrow, rather leathery, and carpels usually four. CLXXV. *E. santalifolia.*

(150) Capsules 1 cm. diameter, and in close clusters of five to eight usually CLXV. *E. capitellata.*

Capsules much less than 1 cm. diameter in loose clusters, usually of three or more. CLXIX. *E. haemastoma.*

(151) Capsules small, under 5 mm. diameter, and hardly longer than broad. CLXXIX. *E. radiata.*

Capsules of moderate size, usually usually 5 to 8 mm. diameter .. 152

Capsules rather large, usually 1 cm. diameter. CLXXVII. *E. pilularis.*

(152) Capsules pear shaped, broadest near the rim. CLXXXI. *E. Considineana.*

Capsules more globose, broadest at the middle 153

(153) Capsules more globose, shortly stalked in close clusters, usually of five or more. CLXXVI. *E. piperita.*

Capsules less globose, a few together in loose clusters 154

(154) Stalks of the capsules more than half the length of the capsule. CLXXX. *E. gigantea.*

Stalks of the capsules very short. CLXXIV. *E. obliqua.*

(155) Leaves rounded, almost as broad as long. CLIII. *E. Baueriana.*

Leaves more or less elongated 156

(156) Calyx covered with a bluish wax, surface warty, as also in the usually large capsule. CXXI. *E. globulus.*

Calyx smooth or rough, but not warty 157

(157) Capsules with a prominent rim and projecting valves, usually in threes, sessile on the stem without pedicels or peduncles. CLXVI. *E. alpina.*

Capsules either stalked, or in two, three, or more on a common stalk (peduncle) 158

(158) Capsules sessile at the end of a common stalk, often narrowed at their base, but without distinct individual stalks .. 159

Individual capsules stalked with distinct pedicels, usually at the end of a common stalk 166

(159) Capsules longer than broad 160

Capsules about as broad as long 161

(160) Leaves narrow, capsules small. CLX. *E. viridis.*

Leaves over 1 to 2 cms. broad, capsules nearly 1 cm. long and cup-shaped. CXXIV. *E. botryoides.*

(161) Peduncles flattened, capsules rather large 162

Peduncles more or less rounded, capsules usually small .. 163

(162) Capsules over 1 cm. diameter. CXXIX. *E. incrassata* var. *angulosa.*

Capsules under 7 to 8 mm. in diameter, broad at the base. CXXV. *E. goniocalyx.*

Capsules 5 to 6 mm. diameter, narrowed towards the base. *E. viminalis.*

(163) Capsules narrowed towards the base 164

Capsules nearly as broad at the base as at the rim and contracting suddenly like a tea-cup. CXXXV. *E. Perriniana.*

(164) Flowers and capsules in clusters at the ends of leafy branches. CXXIX. *E. dumosa* (*E. incrassata* var. *dumosa*).

Flowers and capsules borne laterally on leafy branches .. 165

(165) Leaves, young branches, flowers or even the capsules with a greyish-waxy bloom. CXXXVII. *E. cinerea.*

Plant without any prominent waxy bloom. CXLII. *E. Stuartiana.*

(166) Capsules narrowed at the rim or just below it 167

Capsules not distinctly contracted at the rim 171

(167) Capsules longer than broad 168

Capsules (not including the stalk) hardly longer than broad .. 169

(168) Capsules medium size (averaging 7 by 10 mm.), cup shaped, without an expanded rim. CXXXI. *E. cladocalyx.*

Capsules large, averaging 12 by 18 mm., flask shaped, the rim expanding above the contraction. CXXVIII. *E. corymbosa.*

Capsules small, averaging 5 mm. diameter. CL. *E. fasciculosa.*

(169) Capsules over 7 mm. diameter 170

Capsules under 7 mm. diameter, the valves of the carpels projecting as long free points. CXXX. *E. oleosa.*

(170) Lateral veins very numerous, close together, and parallel. CXXXIX. *E. maculata.*

Lateral veins wide apart, with netted venation between. CLXXII. *E. sideroxylon.*

(171) Capsules large, usually at least 1 cm. diameter. CXXIII. *E. longifolia.*

Capsules over 7 mm. diameter. CXXII. *E. Maideni.*

Capsules of medium size or small 172

(172) Points of the valves projecting well above the rim 173

Points of the valves just reaching or exceeding the rim. CXXIX. *E. incrassata* var. *dumosa.*

Points of valves below level of the rim 174

(173) Flower buds globular, the operculum contracting sharply to a pointed tip. CXLVII. *E. tereticornis* var. *rostrata.*

Flower buds elongated, the operculum narrowing slowly to a blunt tip. CXLVI. *E. tereticornis.*

(174) Pods under 5 mm. diameter. CLVIII. *E. polybractea.*

Pods over 5 mm. diameter. CXXXIV. *E. Gunnii.*

(175) Leaves opposite, fruits in the axils of the leaves. *E. neglecta.*

Leaves mostly alternate and fruits variously situated on stalks .. 179

(176) Calyx and fruits with four prominent angles. CLI. *E. calycogona.*

Calyx and fruits more or less rounded without four prominent angles or ribs 177

(177) Leaves narrow, leathery, the tips usually hard and dry and often forming curved hooks. CLVII. *E. uncinata.*

Leaves broad or narrow, usually not very leathery and without hooked tips 178

(178) Each flower and capsule with a stalk or pedicel of its own (though often very short) in addition to the common stalk (peduncle) 181

Flowers with no distinct pedicels and capsules in a dense cluster seated on the end of the peduncle 179

(179) Fruits shining, the teeth hardly projecting above the rim. CXXVI. *E. nitens.*

Fruits with a rough hardly shining surface 180

(180) Teeth of the valves projecting above the rim. CXXVII. *E. elaeophora.*

Teeth of the valves hardly projecting above the rim. CXXXVI. *E. Kitsoniana.*

(181) Adult leaves rounded about as broad as long. CLII. *E. polyanthemos.*

Adult leaves longer than broad 182

(182) Carpels on a level with the rim or the teeth when open projecting above it 183

Carpels sunk in the capsule, the teeth not projecting above the rim 188

(183) Capsules filter funnel shaped with straight sides. CXL. *E. ovata.*

Capsules with the sides more or less rounded 184

(184) Teeth of the capsules very prominent and vertical when fully open. CXLIII. *E. Bridgesiana.*

Teeth of the capsule valves not very prominent or projecting inwards instead of upwards 185

(185) Capsules small, mostly under 5 mm. diameter. CXXXIII. *E. camphora.*

Capsule of medium size, 5 mm. or more diameter 186

(186) Capsule with a broad nearly vertical lip above the rim. CXLVIII. *E. maculosa.*

Capsule with a narrow lip or the lip sloping inwards from the rim 187

(187) Younger parts with a prominent reddish tinge and bark usually smooth and white. CXLV. *E. rubida.**

Plant without a prominent reddish tinge and bark usually rough. CXLI. *E. Smithii.**

(188) Capsules longer than broad 192

Capsules not longer than broad 189

(189) Capsules over 8 mm. diameter. CLXXIII. *E. leucoxylon.*

Capsules under 8 mm. diameter 190

(190) Capsules 6 mm. or more diameter. CLIV. *E. Bosistoana.*

Capsules under 6 mm. diameter 191

(191) Lamina gradually contracting to form a short petiole less than ½ cm. long. CLIX. *E. odorata* var. *cajeputea.*

Lamina sharply contracting to a distinct petiole at least 1 cm. long. CLXXI. *E. melliodora.*

(192) Leaves contracting sharply at the base to a very distinct petiole .. 193

Leaves contracting gradually at the base to a less sharply defined petiole 194

(193) Capsules with a thin rim. CXLIX. *E. bicolor.*

Capsules with a broader rim (at least 1 mm.). CLXX. *E. paniculata.*

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* I feel much doubt as to whether these names really represent distinct species.

(194) Umbels usually single in the axils of the leaves. CLIX. *E. odorata.*

Umbels in irregular clusters in the axils of the leaves. CLVI. *E. hemiphloia.*

(195) Stamens usually two 196

Stamens four or five 198

Stamens six to ten 240

(196) Leaves rough, like sandpaper (stamens two or three, rarely four). XXI. *Ficus scabra.*

Leaves smooth, stamens always two 197

(197) Fruit, dark bluish berry. CCVII. *Notelaea longifolia.*

Fruit, white to purple. CCVI. *Notelaea ligustrina.*

(198) Flowers with a perianth only, and often male or female. XX. *Trema aspera.*

Flowers with calyx and corolla, though often small 199

(199) The petals free to their bases 200

The petals united at least at their bases 215

(200) Fruit splitting more or less completely into two or more one-seeded cocci 201

Fruit more or less succulent and berry-like 202

Ripe fruit dry and capsular, usually splitting in valves exposing the seeds 205

(201) Leaves simple. XLII. *Geijera parviflora.*

Leaves divided into three leaflets. XLIII. *Zieria Smithii.*

(202) Leaves simple. CXIV. *Hymenanthera dentata.*

Leaves divided into pinnate leaflets 203

(203) Leaflets narrow. CCI. *Tieghemopanax sambucifolius.*

Leaflets broad 204

(204) Leaflets paler beneath. CCI. *Tieghemopanax sambucifolius* var. *angustifolia.*

Leaflets about equally green on both sides. *Tieghemopanax Murrayi.*

(205) A woody climber. XCIX. *Celastrus australis.*

An erect tree, sometimes small and shrubby 206

(206) Flowers very small, usually in dense clusters 207

Flowers of medium size in loose clusters or a few together .. 210

(207) Petals present. CIII. *Pomaderris elliptica.*

Petals absent 208

(208) Flowers in rounded heads. CVI. *Pomaderris betulina.*

Flowers in cymes 209

(209) Styles short. CV. *Pomaderris subrepanda.*

Styles divided almost to the middle. CIV. *Pomaderris apetala.*

(210) Flower with fertile stamens and flattened staminodia. CXI. *Commersonia Fraseri.*

Flowers with all the stamens fertile 211

(211) Fruit flattened and like a shepherd's purse. LV. *Bursaria spinosa.*

Fruit rounded 212

(212) Leaves flat 213
Leaves with incurved margins 214

(213) Petals white. LVI. *Pittosporum undulatum.*
Petals yellow. LIX. *Pittosporum phillyraeoides.*

(214) Petals yellowish. LVII. *Pittosporum revolutum.*
Petals variably purplish to yellowish. LVIII. *Pittosporum bicolor.*

(215) Leaves divided into leaflets. CCXXI. *Sambucus australasica.*
Leaves reduced to minute scales on slender green branchlets, the stalk swollen to an "aril" below the fruit 216
Leaves about as broad as thick and more or less needle-like .. 218
Leaves simple, with a flat lamina many times broader than thick 219

(216) A shrub under 15 feet. Aril swollen and pale lilac. XL. *Exocarpus stricta.*
A tree 15 feet to 30 feet 217

(217) Aril red and succulent. XXXIX. *Exocarpus cupressiformis.*
Top of fruit stalk not much swollen, almost dry and greenish; leaf scales sometimes larger and flatter than usual. XL. *Exocarpus spartea.*

(218) Perianth hairy. XXVII. *Hakea vittata.*
Perianth glabrous 218A

(218A) Corolla yellow; wing of seed dark. XXVIII. *Hakea nodosa.*
Corolla white or pale; wing of seed pale. XXVI. *Hakea leucoptera.*

(219) Fruit hard, woody, about 1 inch long and ½ inch broad, splitting into two halves, freeing one-winged seed. XXIX. *Hakea eriantha.*
Fruits various, but not as above 220

(220) Flowers crimson in a large usually ovoid or globular head or cluster; fruit pod-like and 3 inches or so long. XXXI. *Telopea oreades.*
Flowers various, not as above; fruit usually small or, if larger, globular 221

(221) Fruit small and separating into four one-seeded nutlets, stamens four 222
Fruit separating into two two-seeded nutlets, stamens five. CCVIII. *Ehretia acuminata.*
Fruit small or large but entire, and when dehiscing liberating the seeds from within 224

(222) Leaves rounded, corolla lilac. CCXI. *Prostanthera rotundifolia.*
Leaves longer than broad 223

(223) Leaves broad linear, entire, corolla white or tinged with pale blue and brownish or yellowish dots at the throat. CCX. *Prostanthera nivea.*
Leaves ovate to narrow lanceolate, corolla white or pink tinged with purple spots in the throat. CCXII. *Prostanthera lasianthos.*

(224) Flowers very small, stipules absent, ovary one-celled, fruit a small superior drupe. CCV. *Myrsine variabilis.*

Flowers usually of medium size, stipules absent, carpels single .. 225

Flowers of medium size, rarely small, stipules present, ovary two or more chambered, leaves usually opposite 230

Flowers small, stipules absent, ovary one chambered, leaves often small, opposite or alternate.. 231

Flowers medium to large, no stipules, ovary two or more chambered, corolla five lobed with four fertile stamens of unequal length, leaves soft 232

Flowers medium, no stipules, ovary two or more chambered, stamens as many as corolla lobes, leaves stiff and harsh .. 238

(225) Fruit an indehiscent drupe 226

Fruit a leathery follicle, opening almost flat 228

(226) Leaves very narrow. XXV. *Persoonia linearis.*

Leaves obovate to linear spathulate. XXIII. *Persoonia rigida.*

Leaves lanceolate to oblong lanceolate 227

(227) A tree attaining 30 feet. XXIV. *Persoonia arborea.*

A tall shrub. XXII. *Persoonia lanceolata.*

(228) Leaves long and narrow, well under 1 cm. broad. XXXII. *Lomatia longifolia.*

Leaves over 1 cm. broad 229

(229) Leaves about twice as long as broad, holly like, with broad pointed teeth. XXXIII. *Lomatia ilicifolia.*

Leaves about five times as long as broad, with fine pointed teeth. XXXIV. *Lomatia Fraseri.*

(230) Leaves $\frac{1}{2}$ inch long, flowers solitary. CCXX. *Coprosma Billardieri.*

Leaves 2 inches to 3 inches long, flowers few together in shortly-stalked heads. CCXX. *Coprosma hirtella.*

(231) Leaves under 2 inches long, flowers few in axillary clusters of two or three. XLI. *Santalum obtusifolium.*

Leaves over 2 inches, flowers numerous in a terminal cluster, fruit sweet. XLI. *Fusanus acuminatus.*

Leaves over 2 inches, flowers few, fruit bitter. XLI. *Fusanus persicarius.*

(232) Corolla tube short, the lobes nearly equal 233

Corolla tube longer, the lobes unequal 235

(233) Fruit two-celled, small compressed, dry, ovate oblong. CCXVII. *Myoporum platycarpum.*

Fruit three or more celled, succulent 234

(234) Usually a coastal species, leaves thick, often succulent, usually blunt. CCXVIII. *Myoporum insulare.*

A desert species, leaves firm but not succulent, usually pointed. CCXIX. *Myoporum Dampieri.*

(235) Flowers white 236

Flowers with a blue or red colour or tinge 237

(236) Leaves mostly opposite, sepals obtuse, fruit small and dry. LCCXIV. *Eremophila oppositifolia.*

Leaves mostly alternate, sepals acute, fruit large and dry. CCXV. *Eremophila bignonifolia.*

(237) Leaves short but narrow or channelled with recurved edges, fruit dry. CCXV. *Eremophila alternifolia.*

Leaves very long and narrow, fruit small and succulent. CCXIII. *Eremophila longifolia.*

(238) Corolla lobes bearded inside, ovary two to five celled .. 239

Corolla campanulate, not bearded inside, ovary one celled. CCIV. *Monotoca elliptica.*

(239) Fruit two celled (rarely four), red and succulent. CCII. *Leucopogon lanceolatus.*

Fruit five celled (rarely four), whittish and succulent. CCIII. *Leucopogon Richei.*

(240) Flower pea-like, the two front petals united to form a keel, stamens united at the base to form a sheath around the ovary within the keel.. 241

Flowers not as above 242

(241) Leaves with usually three obtuse leaflets. XCIII. *Goodia lotifolia.*

Leaves reduced to slender petioles or with a few leaflets. XCII. *Viminaria denudata.*

(242) Flowers with a perianth, or the petals absent 243

Flowers with distinct sepals and petals 245

(243) Stamens united at their base to form a central column or cluster. CXII. *Brachychiton populneus.*

Stamens free 244

(244) A tall tree with winged nuts, in groups of three in an involucre. XIX. *Nothofagus Cunninghami.*

A shrub or small tree with a capsular fruit. XCVI. *Omalanthus Leschenaultianus.*

A shrub or small tree with two to three celled and angled dry fruits 249

(245) Leaves divided into two or more leaflets 246

Leaves not divided into leaflets 247

(246) Leaflets two to six, flowers rather small, fruit with globular lobes. C. *Nephelium leiocarpum.*

Leaflets usually nine to eleven, flowers large, fruit a capsule. CXIII. *Eucryphia Moorei.*

(247) Petals united at their bases to form a tube. XLVI. *Correa Lawrenciana.*

Petals free 248

(248) Fruit four celled, somewhat fleshy and quadrangular. XLVII. *Acronychia laevis.*

Fruit separating into small fruitlets (cocci). XLV. *Phebalium Billardieri.*

(249) Sepals as long as the anthers, seeds dull. CII. *Dodonaea viscosa.*

Sepals shorter than the anthers, seeds shining. CII. *Dodonaea triquetra.*

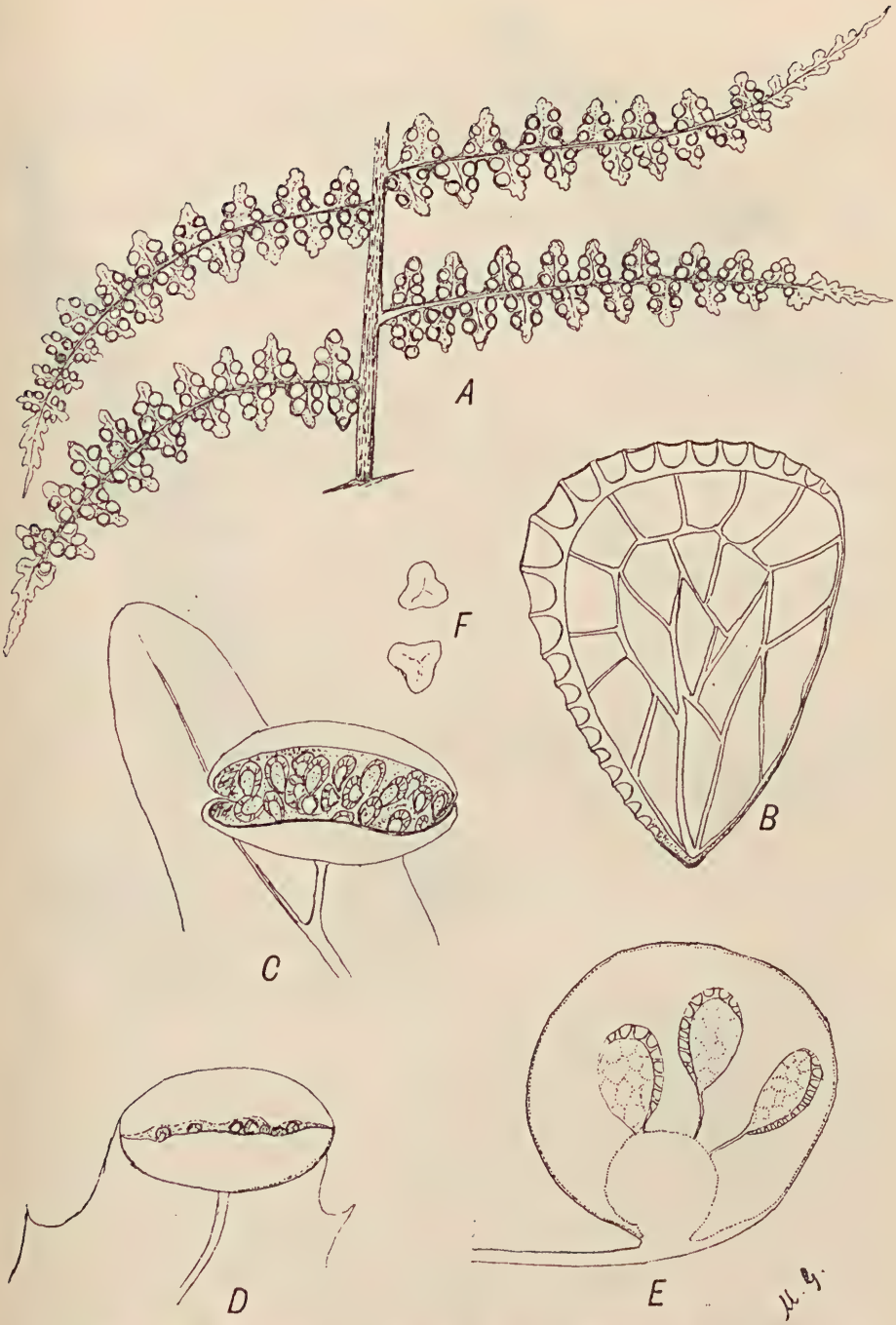


Plate I.—*Dicksonia antarctica.* The Common Tree Fern.

A. Four pinnae of frond with fertile pinnules.
B. Sporangium.
C. Sorus with sporangia and involucre.
D. The same, involucre unopened.
E. Section of sorus and involucre.

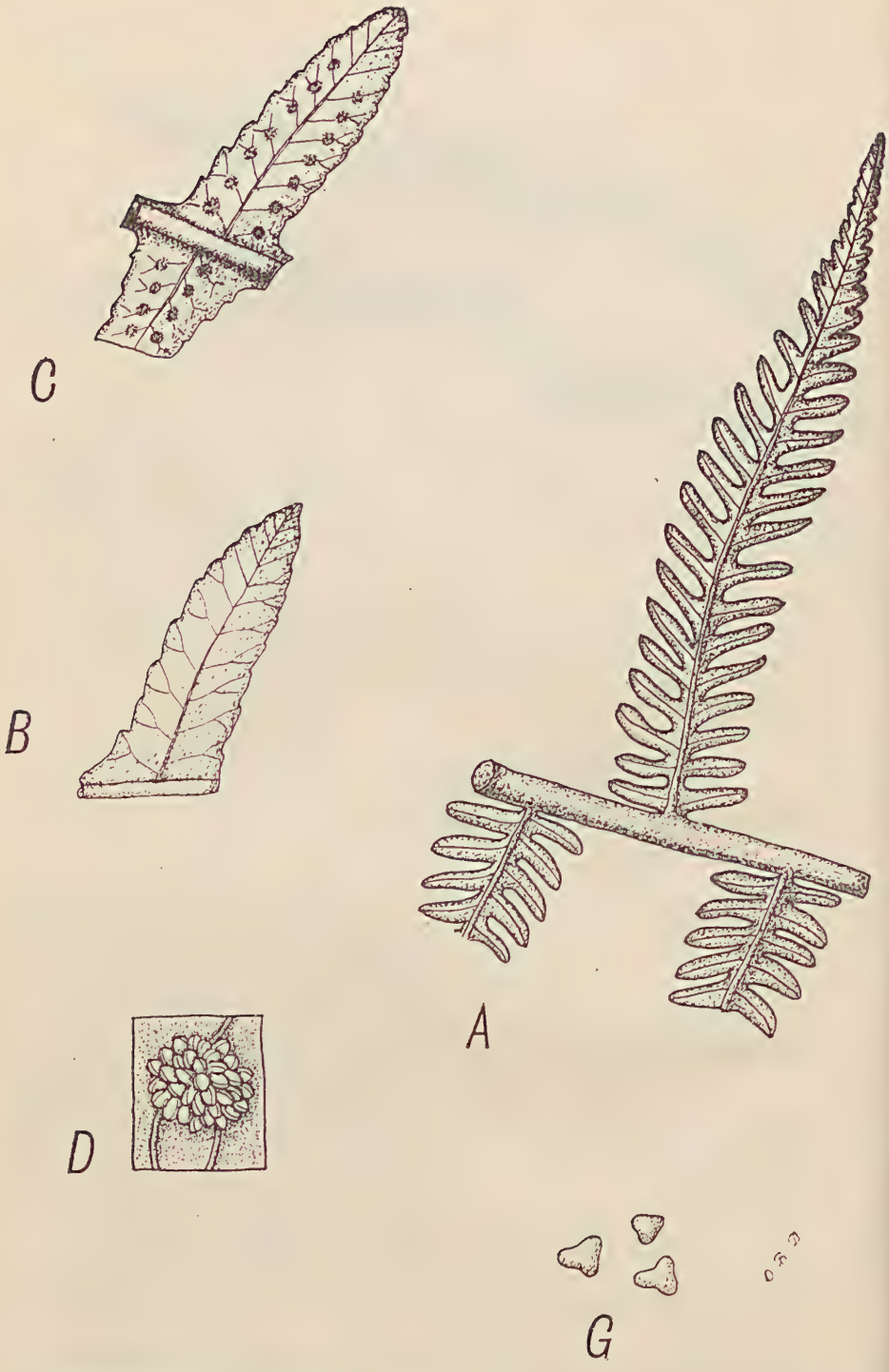


Plate II.—*Alsophila australis*. The Prickly Tree Fern.

A. Portion of frond.
B. Sterile pinnule.
C. Fertile pinnules.
D. Sorus.
G. Spores.

PTERIDOPHYTA.

Cyatheaceae.—Sporangia sessile or shortly stalked on a prominent placenta. Annulus complete, somewhat oblique. Usually tree-like stems, and a cup-like or valvate involucre or indusium.

Dicksoneae.—Sori on the tip of the fertile veins *Dicksonia antarctica*

Cyatheae.—Sori on the backs or forks of the fertile veins .. .. *Alsophila australis*
Cyathea Cunninghami
Cyathea medullaris

Osmundaceae.—Sporangia almost sessile, scattered, no prominent placenta; the annulus represented by a group of thickened cells. No indusium *Todea barbara*

CYATHEACEAE.

Dicksonia antarctica, Lab., "The Common Tree Fern." (Plate I.)

Trunk unbranched, rarely forking in two, erect, up to 20 feet to 50 feet high, covered with the matted descending rootlets. Frond 6 feet to 12 feet long, pinnate and usually thrice compound, the sori at the ends of the lobes of the pinnules and enclosed by two valves (an indusium and the modified tip of the pinnule lobe).

A native of all the States, excepting Western Australia and the Northern Territory. Also in New Zealand.

The stem is usually under a foot in diameter, but may broaden at the base to a diameter of as much as 4 feet. The central cylinder of the stem contains no actively growing tissue below 2 feet or 3 feet from the top. The water is carried upwards mainly by the superficial roots. The matted surface is made up of interlacing dead and living roots. The dead stems can be used as steps in a fernery, being fairly durable. The pith at the top of the trunk contains much starch, and was formerly used raw or roasted by the aborigines as food. When the living fern is transplanted, it must be given shade and shelter from hot north winds. A steady drip of water on the crown aids fresh roots to grow down from the crown to the soil. This can be done by suspending a kerosene tin filled with water over the crown, with a piece of string drawn through a hole in the bottom of the tin.

Alsophila australis, R.Br. "The Prickly Tree Fern." (Plate II.)

Alsophila is easily distinguished from *Dicksonia* by the globular sorus without any indusium, although one of the small scales scattered on the veins may occasionally subtend a sorus. The sori occur in two

rows on each side of the midrib on the backs of the fertile segments, which have rounded indentations on their edges, whereas sterile segments have more pointed indentations. The main axis of the frond has its surface roughened by rounded or almost prickly projections, which sometimes extend to the secondary branches of the frond.

The stem of *Alsophila* is usually more slender than that of *Dicksonia*, and it varies from 8 feet to 60 feet in height, rarely exceeding 60 feet. The fronds are 5 feet to 12 feet long. This tree fern is native to Queensland, New South Wales, Victoria, and Tasmania, but only grows well in damp and shady localities, and usually soon dies when the forest cover is removed.

The stems can be used for rustic works, rustic steps, &c. The hard outer portion of the stem beneath the covering of roots can be used for walking sticks or fancy furniture, but the brown bands of sclerenchyma are very hard and the softer tissue between is apt to break away. When the plant is grown in gardens it must be placed in damp shaded localities, protected from hot dry north winds, and the same precautions are needed to establish it as in the case of *Dicksonia*. The superficial coating of roots is usually less developed than in the case of *Dicksonia*, and the wood tissue of the stem takes a greater part in the upward conveyance of water.

Cyathea Cunninghami, Hook, fil. " The Slender Tree Fern." (Plate III.)

This tree fern is of limited range, and occurs only in the cooler moist regions on the south of Victoria in shady localities.

The stem is slender, dark coloured at the base, and attaining a height of 30 feet to 50 feet. It bears a crown of 20 to 30 fronds, each 6 feet to 10 feet long, and twice or thrice pinnate. The pinnules are rather sharply pointed. The sori in this and the following species occur one on each of the lobes of the pinnules, and are enclosed in a globular membrane, which splits when ripe, forming a cup or ring around the cluster of practically unstalked sporangia. In *C. Cunninghami* the midribs of the pinnules are hairy on the upper surface, whereas in *C. medullaris* they are glabrous. In other respects these two species are closely related, but *C. Cunninghami* is more typically a New Zealand species, with a few outliers in South Victoria, whereas *C. medullaris* extends also to Tahiti and Tasmania. The pith at the apex of the stem contains starch, and was used by the aborigines as food.

Cyathea medullaris, Sw. " The Black Tree Fern." (Plate IV.)

The general characters are closely similar to those of *C. Cunninghami*, but the plant is usually smaller, only rarely attaining heights of up to 40 feet, and the stem in particular is darker in colour, the branches of the frond less hairy, and the pinnules blunter.

Plate III.—*Cyathea Cunninghami*. The Slender Tree Fern.

A. Segment of fertile frond from under side.
B. Back and side views of sporangium.
C. Spores.
D. Section of sorus with involucre, paraphyses, and sporangia.
E. Fertile pinnule with sori on under side.

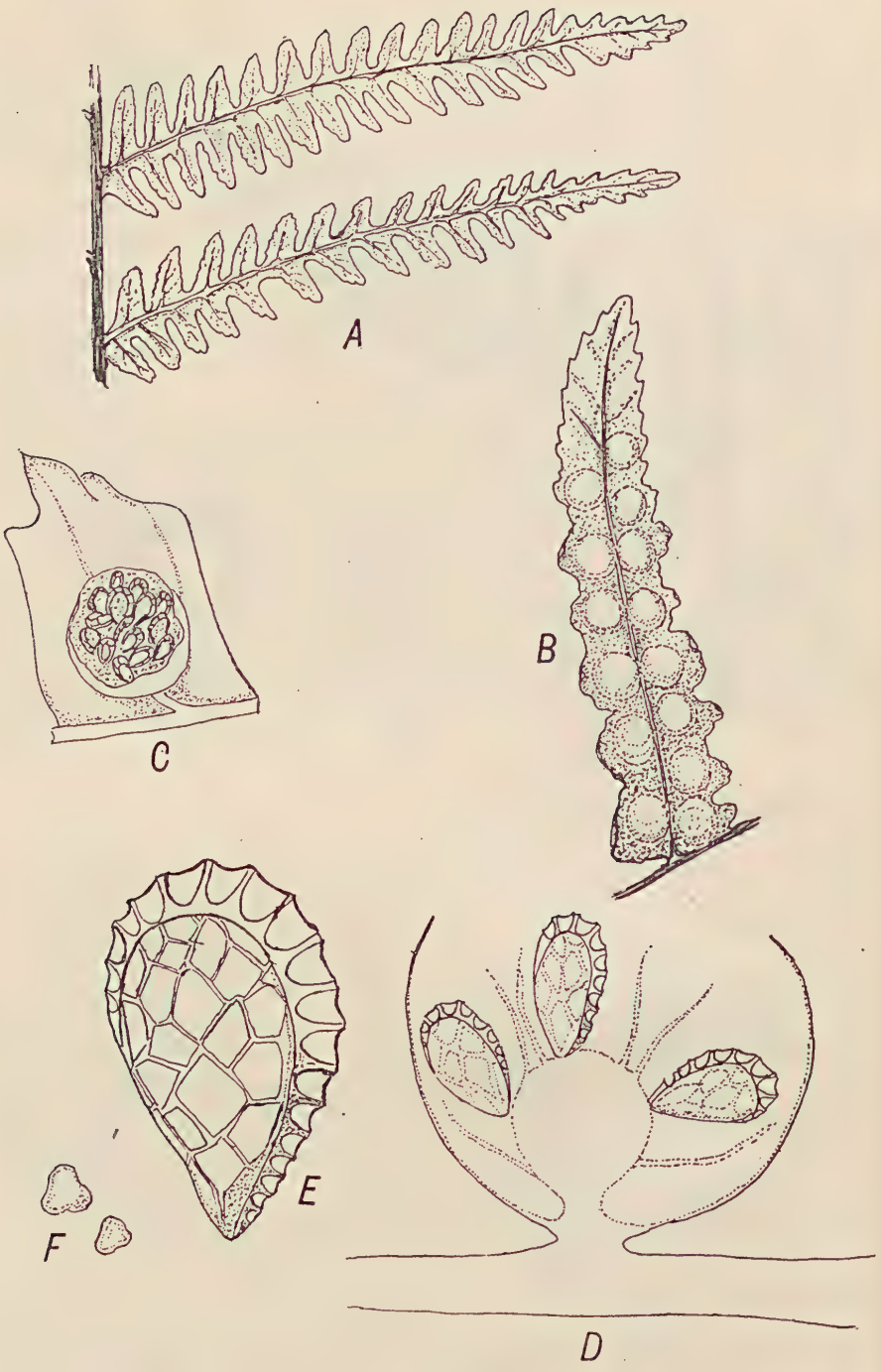


Plate IV.—*Cyathea medullaris.* The Black Tree Fern.

A. Two pinnae of frond and pinnules.
B. Fertile pinnule.
C. Sorus with sporangia and involucre.
D. Vertical section of same.
E. Sporangium.
F. Spores.

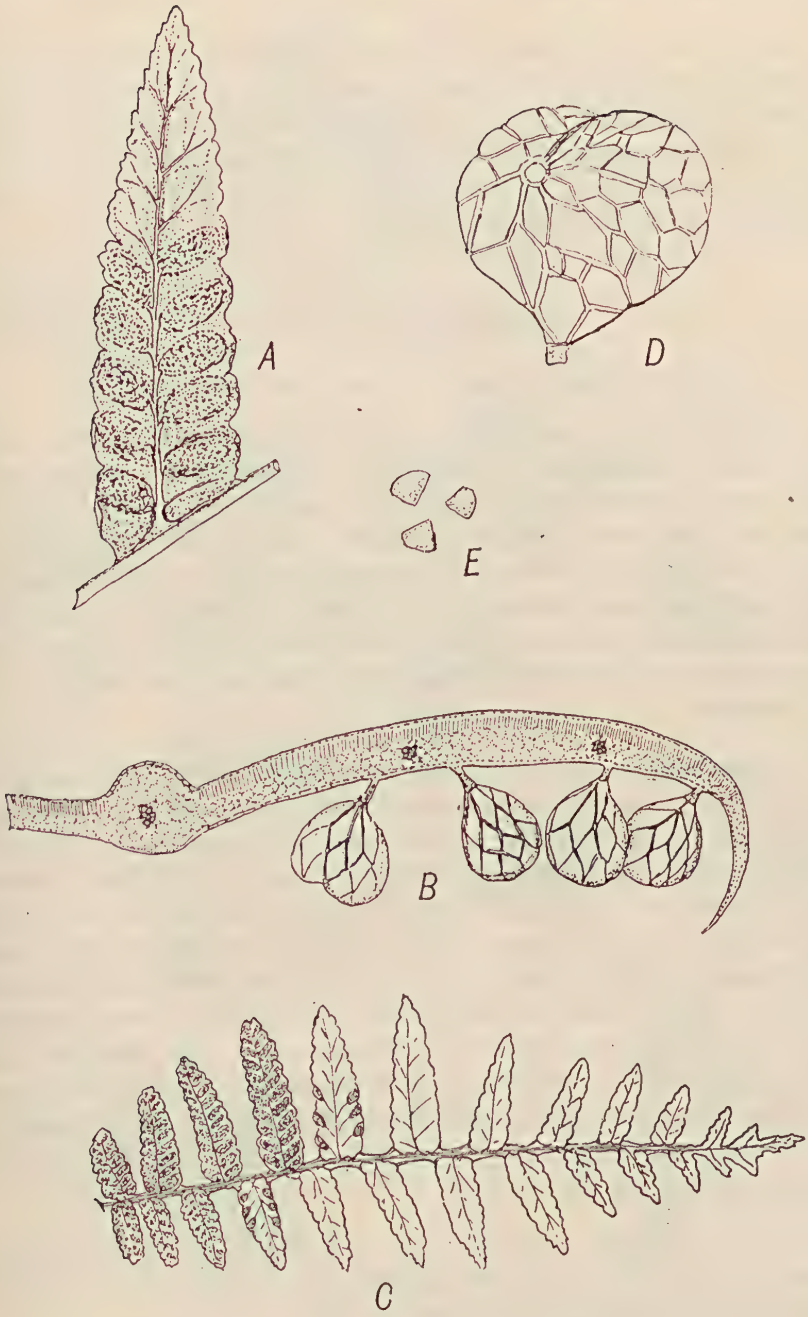


Plate V.—*Todea barbara.* The King Fern.

A. Fertile pinnule.
B. Transverse section of same.
C. Pinna of frond with pinnules.
D. Sporangium.
E. Spores.

The economic uses are the same as for Tree Ferns in general.

Cyatheas are more difficult to grow successfully in gardens than the commoner Tree Ferns. The pith is prominent, and the split apex of the stem is sometimes used by trappers to attract wallabies to traps. The superficial coating of roots is only developed at the base of the stem and the upward conduction of water takes place almost wholly through the wood tissue of the stem.

OSMUNDACEAE.

Todea barbara, Moore. "King Fern." (Plate V.)

The King Fern grows wild in shady forest localities, mainly in the Otways and in Gippsland. The fronds of this fern are as large as in the preceding forms, but the stem is short and stout, rarely more than 6 feet high, and branching twice or thrice, so that one plant may bear two or more crowns of foliage. The fronds are twice pinnate, and the pinnules are oblong to lanceolate and slightly toothed at the tips only. The sporangia are stalked and globular, with no proper annulus, and they occur in irregular brown felt-like masses on the under side of the fertile basal pinnules.

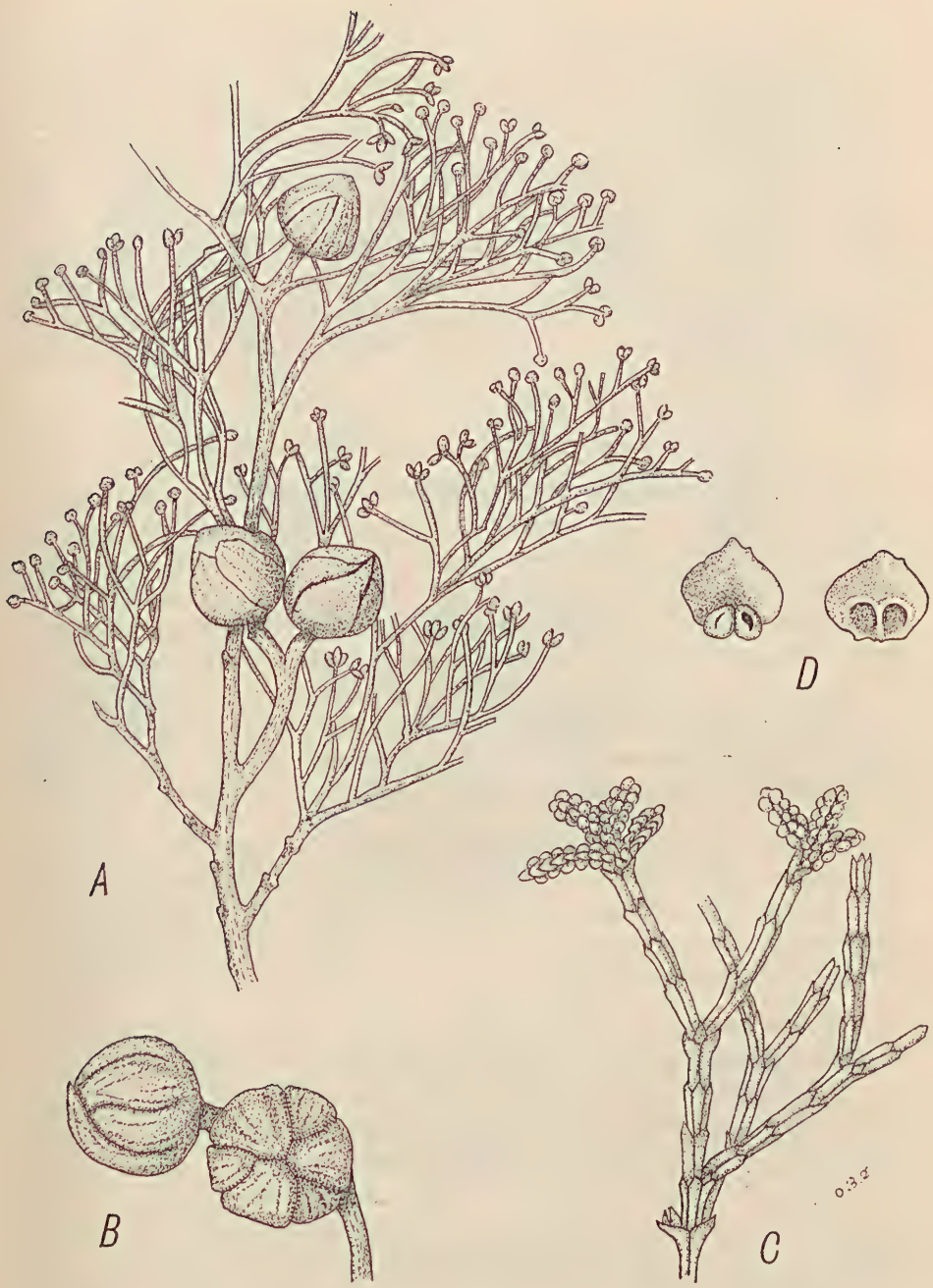
The plant has no special economic uses, but forms a very handsome addition to a fernery when successfully transplanted. The stem though thick, is of very slow growth, and adult specimens of 6 feet to 10 feet in height may weigh 2 cwt. or more. Like all Tree Ferns it attains a considerable age. The larger Tree Ferns growing wild in undisturbed bush are usually over 100 to 200 years old, as judged by observations on the annual rate of growth, or by counting the remains of successive crowns of foliage. Even the tallest Tree Ferns do not grow more than a few inches a year in height, and the stem of a large plant of *Todea barbara* growing near Heytesbury in three years did not quite increase an inch in length, so that its height of 5 ft. 10 in. might represent a growth of 200 years. Possibly, however, growth in height may be more rapid when the plant is young.

All of the five above Tree Ferns grow in abundance in the Lilly Pilly and Sealers Cove Gullies of the National Park, Wilson's Promontory, the *Cyatheas* reaching heights of over 40 feet.

GYMNOSPERMAE.

Seeds not enclosed in an ovary, and usually on the surface of scales or scale-like leaves, arranged in cones (Pines) or clusters (some Cyads).

Pinoideae (*Actinostrobineae*)	*Callitris.*
Taxoideae (*Podocarpeae*)	*Podocarpus.*



Huegelii (syn. glauca) ✓

Plate VI.—*Callitris ~~robusta~~*. The Murray Pine.

A. Twig bearing male flowers and cones.

B. Cone of Murray Pine from Mildura, Victoria, furrowed on the valves.

C. Branchlet bearing male flowers.

D. Scale from male cone with anthers, back and front view.

The leaves are reduced to scales or needles usually in rings of 2, 3, or 4. The cones have 4, 6, or 8 woody valves, usually half of which are smaller and more external, and all opening out when ripe from the top, forming an open calyx, in which the seeds lie loosely attached to the scales. Seeds doubly winged 2, 3, or more. The cone takes one to two years to ripen. The genus yields an important exudation, sandarac resin. The wood has a slight camphor smell, and is resistant to white ants. It is useful for furniture, floorings, linings, palings, &c. It forms good fuel, with a pleasant fragrance, but burns rather quickly and fiercely. The seeds are short-lived, rarely giving good germination in the second year.

Callitris robusta, R.Br., " Murray Pine." (Plate VI.)

It is distinguished from the two following species by the usual absence of any furrowing at the junction of the cone valves, and by the more slender and looser male cones. The seeds are usually two-winged and the cone valves without any dorsal point and smooth or verrucose on the back. It is usually a tall pyramidal tree, from 50 feet to 80 feet in height, with a diameter of 1½ feet to 2 feet, and is a native of all the States of Australia, but grows better towards the north than in the extreme south. A northern variety (*microcarpa*) has small cones, while a variety (*verrucosa*) with large cones and warty cone valves occurs in the drier interior along with the ordinary smooth-valved form.

The tree will grow on poor soils, and stands great heat and a considerable degree of drought. Under such extreme conditions, however, it is of slow growth and may be dwarfed to a shrub. It readily establishes itself from seed, and often forms a dense low scrub, which requires thinning before it will yield good timber.

The timber varies from light to dark brown, sometimes with a reddish tinge and a paler sap-wood, and is fairly dense, a cubic foot weighing 40 to 45 lb. when seasoned. The grain and polish are good. Though the timber from isolated trees is apt to be knotty, the knots do not fall out, and the timber seasons well with little shrinkage. When closely grown it is very free from knots. It is a durable softwood easily worked and polished and resistant to insects, including white ants. The slight camphor smell usually makes it unsuitable for butter boxes, but it is a good furniture timber, and can be used for linings, flooring, weatherboards, doors and mantelpieces, &c. Although resistant to white ants, it is liable to dry rot and hence does not form good house blocks. The oil distilled from the twigs and fruits contains pinene, limonene, geraniol, borneol and acetic acid.

The variety *verrucosa* (*C. verrucosa*, R.Br.) has the cones more or less covered with warty excrescences. It is a dwarf mallee form usually too small to be of use for timber.

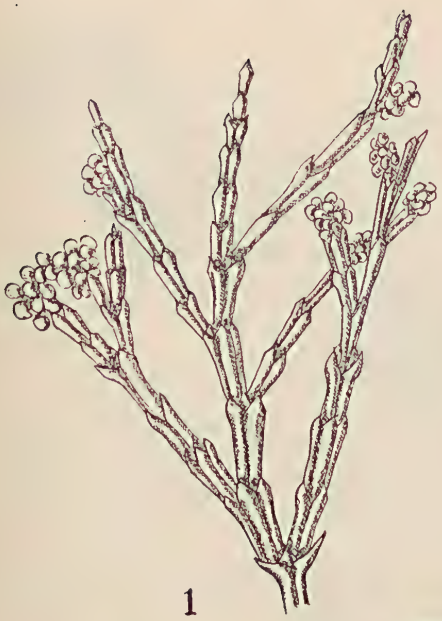


Plate VII.—*Callitris* ~~*cupressiformis*~~ *rhombeidea*. The Cypress Pine.

1. Branchlet bearing male flowers.
2. Branchlet bearing female flowers.
3. Cone just opened.
4. Cluster of opened cones.
5. Seeds.
6. Cones (var. *mucronata*).

7 and 8. Front and back views of stamens with anthers. (Magn.)

Plate VIII.—*Callitris calcarata*. The Red Pine.

A. Seedling.
B. Young cone.
C. Cone opened, showing the multiple columellas or aborted ovules.
D. Branchlet, showing female flowers.
E. Branchlet bearing male flowers.
F. Cone.
F1. Seeds.

Callitris cupressiformis, Vent. " The Cypress Pine." (Plate VII.)

This species can be distinguished from the following by its globular cones (instead of ovoid or oblong) with the inner larger valves swollen at the top, with the dorsal point near the top as in *C. calcarata*.

It is a native mainly of the East of Australia, and is a more southerly species than *C. robusta*. (Queensland, New South Wales, Victoria, South Australia and Tasmania.) A variety with the dorsal point on the larger cone valves very prominent (*var. microcarpa*) occurs in the Grampians.

It is a tree of 20 feet to 50 feet with a diameter of 1 foot to 2 feet, but often smaller or dwarfed, and although of more restricted range than *C. robusta*, it appears to grow in a greater variety of localities, including even coastal regions and mountain sides. In Victoria it grows on the Grampians and Genoa Ranges, as well as on low sandy country in the Wimmera. The trunk is rarely more than 18 inches in diameter. Hence it is not a good saw-mill tree, but is useful for telegraph posts, cabinet work, or for all purposes where small timber is needed. The timber is strong, durable, close grained and seasons well, but has little figure. The sap-wood is paler and decays more readily, or is liable to the attacks of borer. The resin of this species and the previous one can be obtained from natural exudations or from incisions in the bark, and is similar to the sandarac resin of *Callitris quadrivalvis* used as a varnish.

The oil distilled from the leaves contains pinene, limonene, geraniol, acetic acid and but little or no borneol.

Callitris calcarata, R.Br. " The Red Pine." (Plate VIII.)

It is a native of the Eastern States, growing in Victoria on the Ovens River, and is sometimes known as the Black Cypress Pine. It usually grows on ridges or hillsides, but also near the coast in New South Wales. *C. calcarata* has dark reddish brown seeds and bright green foliage, and the cones are very persistent, while *C. robusta* has pale brown seeds and silvery green foliage, and the cones fall more readily. The tree is usually of medium size, but may attain a height of 50 feet or more. It grows on poor sandy soils and produces a durable fine-grained fragrant timber capable of taking a high polish, and therefore valuable for furniture, cabinet work and inlay work. The duramen is dark and the figuring with black, white or yellow streaks usually prominent, so that it can be used for wainscots, panelling, &c., but the grain is too free to make it useful for general purposes. It lasts fairly well in dry ground and resists white ants. It is more brittle, less durable and more liable to knots than the Murray Pine.

The leafy twigs and fruits on distilling yield an oil containing limonene, borneol, geraniol and acetic acid.

In the variety sometimes known as *C. Muelleri*, the spaces between the insertions of the leaf scales are longer, the branchlets are coarser, and there is a single central columella in the cone, whereas in the ordinary form of *C. calcarata*, abortive ovules at the centre of the cone often give the appearance of several small irregular columellas.

PODOCARPUS.

Can be recognized by its exposed fleshy seeds and its spreading rows of flat narrow leaves. The seeds are short-lived, rarely germinating when more than a year old.

Podocarpus alpina, R.Br. "Alpine Podocarp." (Plate IX.)

This is an alpine shrub usually growing over 3,000 feet above sea level. Mount Buller, Mount Wellington and Hardinge Range, Cobberas Mountains and Mount Hotham. It is usually low and densely branched but occasionally reaches a height of 10 feet or 12 feet. The stems are at most only a few inches thick and usually gnarled and twisted. At lower elevations (2,500 feet Mount Goonmirk, East Gippsland) it may become a small tree up to 30 feet in height. Leaves linear lanceolate. Carpels, single-stalked in the leaf axils. Stamens clustered at the ends of branch, each with an appendix.

The wood can be used for turnery and ornamental work. *P. alpina* is the only Victorian representative of the genus, but the *Podocarpus elata* of Queensland and New South Wales is a tall tree up to 100 feet in height, yielding a valuable tough fine-grained durable softwood timber, fairly resistant to white ants and having a density when air dry of about 45 lb. per cubic foot.

MONOCOTYLEDONAE.

PALMEÆ.

LIVISTONA.

Livistona australis, Mart. "Cabbage Palm." (Plate X.)

This tall palm with a terminal rosette of stiff compound leaves attains a height of 40 feet to 80 feet, rarely 100 feet or more. It is the only native palm in Victoria, and extends from New South Wales into Victoria down the east coast, owing to the ameliorating action of the neighbourhood of the sea upon the climate. It is really a semi-tropical plant. The fruit is round, dark coloured and usually between ½ inch and 1 inch in diameter. The seeds are round also. The natives formerly used the apical bud or heart of the tree as food, hence the name Cabbage Palm.

Plate IX.—*Podocarpus alpina.* The Alpine Podocarp.

Leafy branch with male and female flowers.

A. Female flower (carpel) with exposed seed.
B. Seed.
C. Stamen.
D. Male inflorescence.

Plate X.—*Livistona australis*. The Cabbage-tree Palm.

A. Entire tree.
B. Spathe of inflorescence and portion of inflorescence on left.
C and D. Flowers enlarged.
E. Fruit.

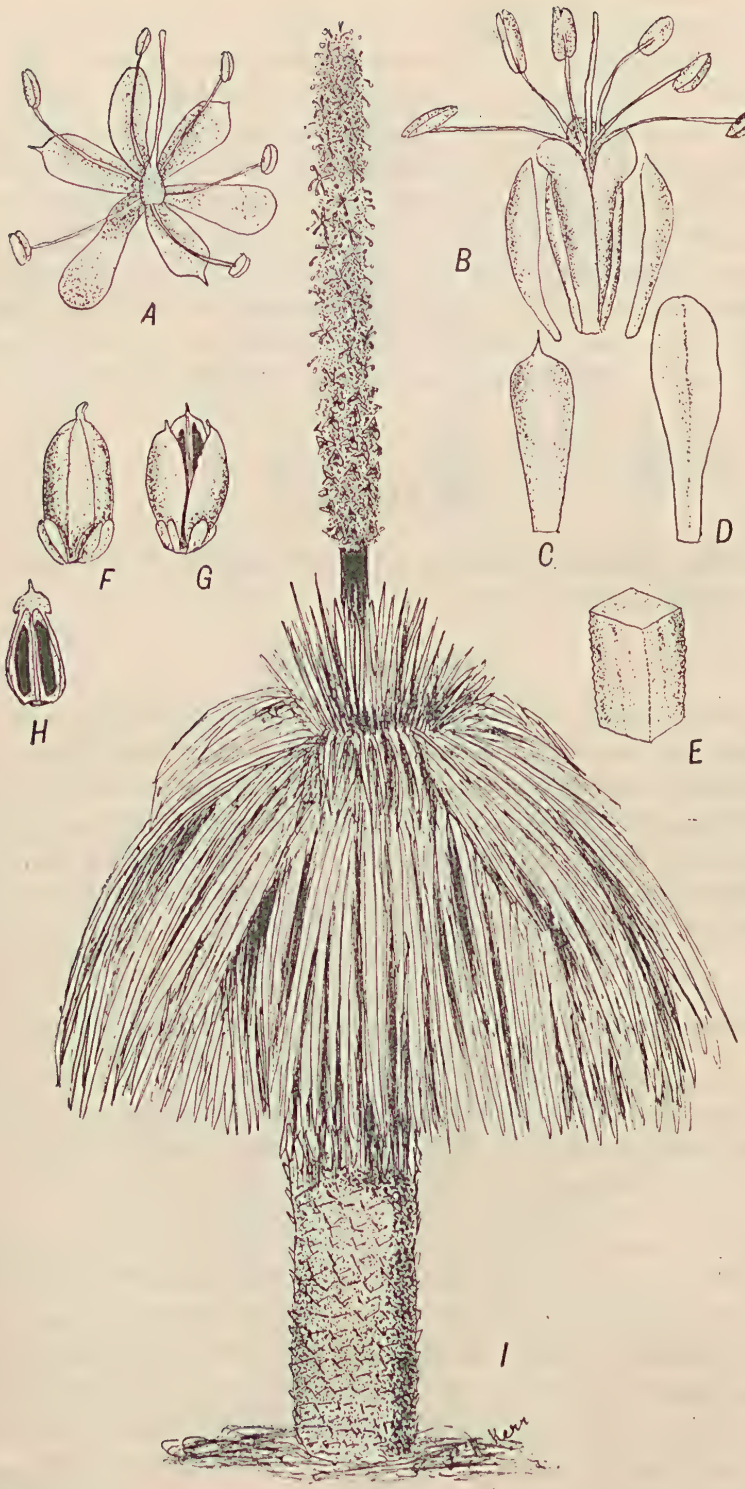


Plate XI.—*Xanthorrhoea australis*. The Southern Grass Tree.

A. Flower (face view).
B. Flower and bracts (side view).
C. Outer perianth segment.
D. Inner perianth segment.
E. Portion of leaf.
F. Fruit.
G. Fruit (dehisced).
H. Seeds *in situ*.
I. Plant.

The trunk is rarely more than 12 inches to 18 inches diameter at six feet from the ground, but the interlacing roots usually give a broad base of support. The central part of the stem is rather soft with scattered bundles, but in the outer part the bundles are closer, and have marked sclerenchyma sheaths, so as to form a harder and darker layer of apparent wood tissue. It really contains both wood and inner bark tissue (*Phloem*) intermingled. Walking sticks can be cut from the outer layers. Pig troughs can be made from sections of the stem hollowed out, and lengths of the trunk can be used for supports in rosaries, summer houses, pagodas, &c. The leaves can be used for the manufacture of hats. The seeds are short-lived. Five to eight year old seed entirely failed to germinate.

LILIACEAE.

Only one Victorian genus of *Liliaceae* approaches tree-like dimensions, namely, the Grass Tree.

XANTHORRHOEA.

The stem is stout covered by the bases of the old leaves, with a terminal rosette of narrow linear leaves, 3 feet or so in length, and with an upright spike of flowers on a short stout stalk with a total height of sometimes 10 feet to 15 feet on a stem of 4 feet to 6 feet. Flowering is irregular, but usually takes place freely after a grass fire in spring or summer. Grass Trees usually indicate either poor land, land wet in winter and dry in summer, or land requiring drainage and liming.

Xanthorrhoea australis, R.Br. " Southern Grass Tree." (Plate XI.)

Stem prominent. Leaves 3 feet or 4 feet long, linear; spike longer than the bare portion of the scape. Flowers surrounded by scaly bracts, the latter and the sepals not hairy at the tips. Leaves more or less quadrangular in section.

This is the commonest Grass Tree in Victoria, and is easily recognized by the dark red resin, which forms between the leaf bases. This resin is formed in cortical cells on the surface of the stem developed from a superficial cambium layer. These cells die and decay, allowing the resin to accumulate around the leaf bases. The resin yields 15 per cent. to 20 per cent. of picric acid when treated with nitric acid. It is soluble in alcohol and forms a useful colour varnish. Although the leaves grow rapidly the stem grows very slowly. Stems over 5 feet to 6 feet in height may be 50 to 100 years old. The resin is obtained by hacking off the leaf bases and outside of the stem, which usually destroys the plants. The collection of the resin as ordinarily practised is therefore only a temporary industry on uncleared land.

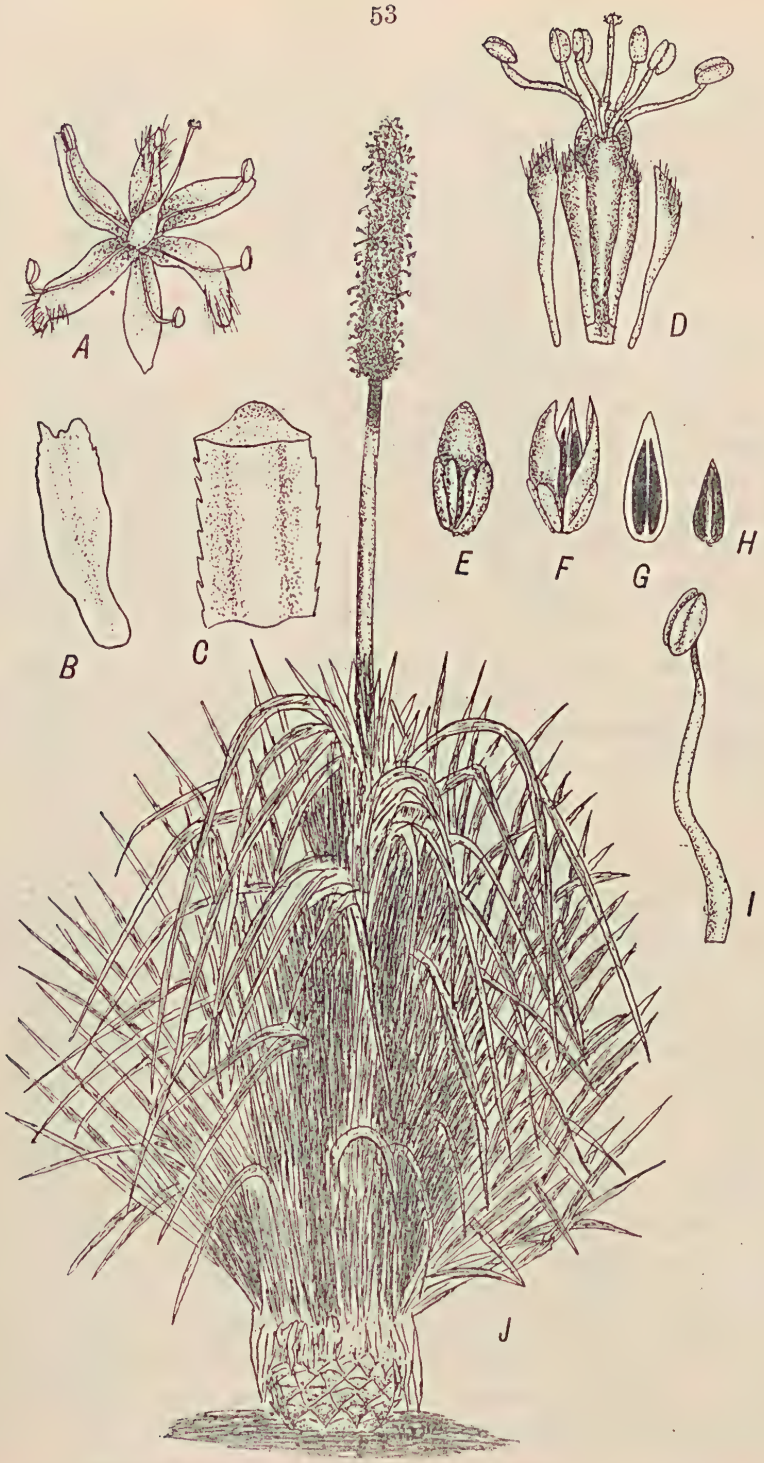


Plate XII.—*Xanthorrhoea hastilis.* The Spear Grass-tree.

A. Flower (face view).
B. Inner perianth segment.
C. Portion of leaf.
D. Flower and bracts (side view).
E. Fruit.
F. Fruit (dehisced).
G. Seeds *in situ*.
H. Seed.
I. Stamen.
J. Plant.

Bees use the pollen and also produce a strong unpalatable honey from the nectar. They collect the resin and use it to fill cracks or cement together the frames in the hive, where it is a nuisance to the bee-keeper. It flowers every few years, or freely after bush fires. The resin can be removed from the hands by rubbing them with fat or butter and then washing with much soap and little water, or by washing in strong alcohol.

Xanthorrhoea hastilis, R.Br. "Spear or Yellow Grass Tree." (Plate XII.)

Stem short, often scarcely prominent. Leaves 3 feet to 4 feet long and with a broad almost membranous base, becoming suddenly linear, subulate re-curved harsh and rigid, tapering to a fine point, more or less triangular in section. Scape 6 feet to 8 feet in length; the bare basal portion of the spike 1½ feet to 2 feet and about 1 inch in diameter. Flowers surrounded by scaly bracts and arranged spirally around axis, sessile, small. Bracts and sepals densely rusty-tomentose on ends.

This plant extends down the Eastern coast into Victoria, being fairly abundant in Croajingolong. Its resin is paler and yellow in colour, darkening when heated. It yields 20 per cent. to 30 per cent. of picric acid after treatment with nitric acid, and can be used as a pale spirit varnish.

CASUARINEAE.

A small order, containing a single genus *Casuarina*, best represented in Australia, but with several species in New Caledonia, four on the Sunda Islands, and one on the Pacific Islands and tropical Asia. One species *C. equisetifolia* grows in sandy coastal districts in tropical Asia, Australia and in Algeria, and yields an extremely hard and durable iron-wood. It is worth preservation and re-planting in the Northern Territory.

Trees or shrubs with the external appearance of Horsetails (*Equisetum*), with whorled, jointed, grooved branches, the leaves reduced to pointed scales fused at their bases to form a leaf sheath at each joint. Flowers unisexual, the males in slender terminal cones. Each cup-like sheathing scale encloses a few male flowers, represented by a single stem, and two or three bracts carried up at first on the anther, then falling. Female flowers each of a single carpel with two styles, clustered in lateral heads forming a woody cone when ripe. Each fruit with a single seed and splitting by two terminal more or less pronounced valves.

In internal structure *Casuarina* is related to *Ephedra* among the *Gymnosperms*, and possibly through *Ephedra to Equisetum.*

The bark contains much tannin and a brown dye, Casuarin, which dyes silk and wool a fast brown. The seed, though not hard, may remain germinable for five to ten years. Seeds of *Casuarina suberosa* twelve years old gave 62 per cent. germination.

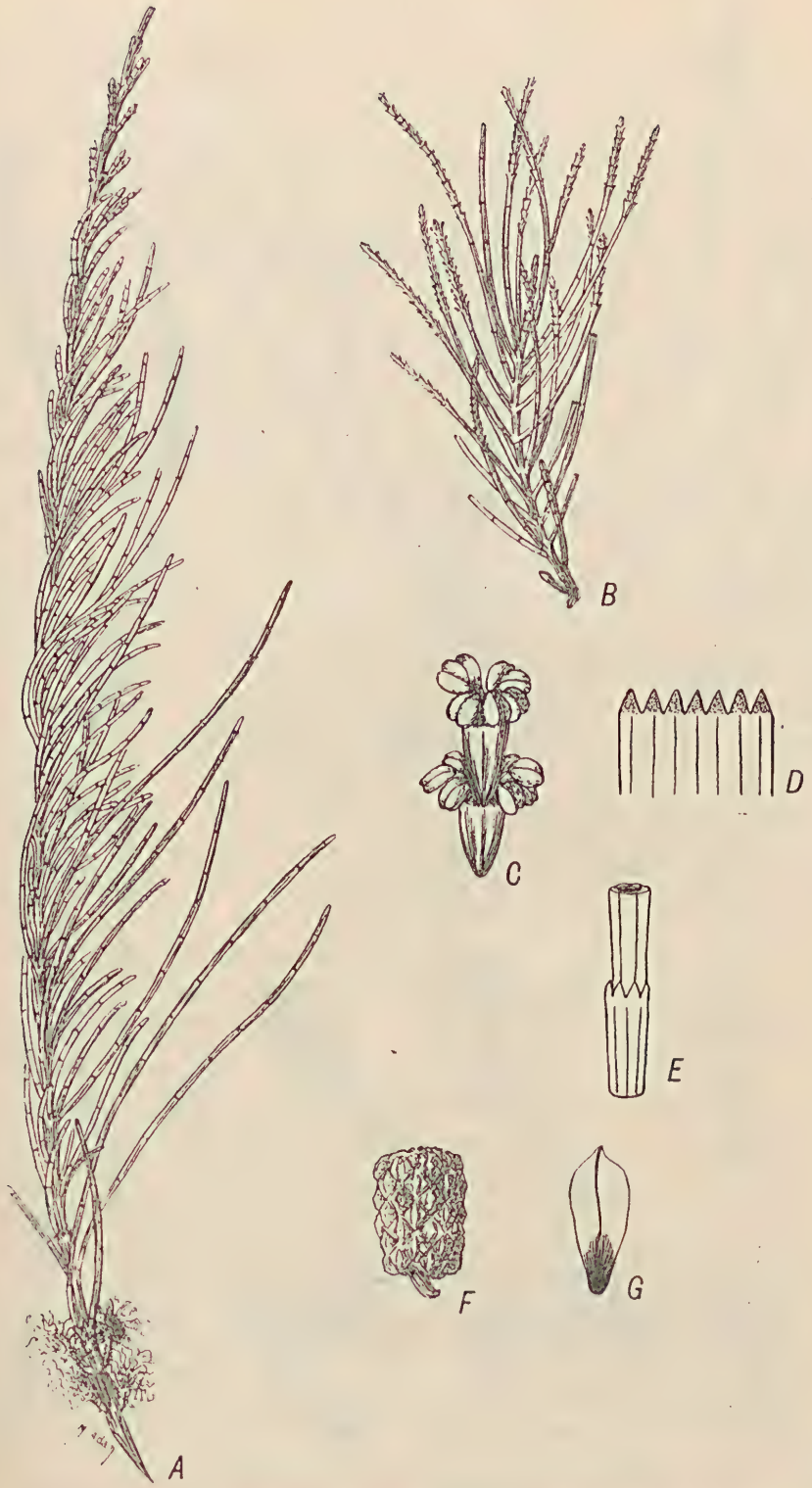


Plate XIII.—*Casuarina distyla.* The Stunted Sheoke.

A. Shoot with female flowers.
B. Shoot with male flowers.
C. Two male flowers.
D. Leaf teeth.
E. Node of branch with leaf teeth.
F. Cone.
G. Seed.

Plate XIV.—*Casuarina glauca.* The Swamp Buloke.

A. Cluster of female flowers.
B. Branchlets and female flowers.
C. Ripe cone.
D. Winged seed.
E. Leaf sheath split open.
F. Single whorl of male flowers.
G. Spikes of male flowers.
H. Single male flower with stamen.

CASUARINA.

Casuarina distyla, Vent. "Stunted Sheoke." (Plate XIII.)

Description.—A dioecious shrub with erect spreading branches but in favorable situations becoming a small tree 10 feet to 20 feet high. Branches glabrous or slightly hairy. Leaf sheaths with six to eight, usually seven, short teeth. Male spikes on deciduous branchlets of 1 inch to 3 inches on persistent branches. Fruit cones sessile or nearly so, from ¾ inch to 1 inch long.

Habitat.—A native of Southern Victoria, in Gippsland, near Melbourne and Wilson's Promontory. Also New South Wales, Tasmania, South Australia and Western Australia.

Usually in sandy or swampy localities.

Timber.—It is too small to have any timber value, except for turnery, cabinet work and fuel, but it is useful as an aid in the prevention of sand drifts in dry districts and exposed coastal localities. In time of scarcity it affords a certain amount of fodder for stock, but is a low grade fodder as regards both nutrient value and digestibility, as well as being somewhat astringent. The same applies to the larger *Casuarinas* which when pollarded are sometimes used as a fodder standby in drought seasons.

According to Miss Macklin, Siebers *C. paludosa,* which is generally placed as a variety of *C. distyla,* is a distinct species differing in its greater size, in its stamens yellow instead of red, with longer filaments, and oblong instead of rounded anthers, in having each assimilating ridge divided by a median radial band of sclerenchyma which is absent in *C. distyla,* and in having a greater development of sclerenchyma in the stem. *C. distyla* is strictly dioecious, but *C. paludosa* is frequently monoecious, and has also coarser and more cylindrical branches.

Casuarina glauca, Sieb. "Swamp Buloke." (Plate XIV.)

Description.—A tree often growing to a height of 40 feet or 50 feet with a diameter of 2 feet, or even more, with a cracked flaky bark, and favoring wet and swampy localities, or river banks. In more open, drier localities it is smaller and very glaucous. Leaf sheaths with nine to sixteen teeth, usually ten to fifteen. Male spikes ½ inch to 1 inch long. Cones on short thick stalks rounded to flat-topped. About ½ inch diameter, but occasionally smaller, the valves prominent. Seed winged, small and grey.

Habitat.—A native of North-Western Victoria, mainly in the Mallee, but also in New South Wales (coastal districts), Western Australia, and Queensland. It usually grows in swampy places, or by tidal creeks, sometimes near salt water, but will also grow in drier inland localities.

Timber.—Light brown outside to dark brown at the centre, hard, strong, durable. It shows a beautiful figure owing to the prominent medullary rays. Useful for tool handles, bullock yokes, furniture,

Plate XV.—*Casuarina ~~lepidophloia~~ cristata*. The Belah.

A. Branch with ripe and unripe fruit.
B. Staminiferous flowers.
C. Node of branchlet with leaf teeth.
D. Male flowers with involucre.
E. The same opened out.
F. Nut with seed.
G. Single male flower with perianth segments.

Plate XVI.—*Casuarina Luehmanni.* The Buloke.

A. Branch with female flower clusters.
B. Branch with fruits in cones.
C. Seed.
D. Spikes of staminate flowers.
E. Two whorls of staminate flowers from male cone.

fittings, cabinet work and veneers. Polishes well but is difficult to plane smooth. A cubic foot weighs 56 lb. when seasoned. Tranverse breaking stress 8,000 to 9,000 lb. (3 feet x 3 in. x 3 in.). These figures refer throughout to 3 inch rectangles 3 feet long unless other dimensions are given.

Casuarina lepidophloia, F.v.M. "Belar." (Plate XV.)

Description.—A small tree rarely exceeding 20 feet to 30 feet, with smooth or faintly ribbed ascending branchlets. Leaf sheaths usually with nine to ten teeth. Female cones nearly an inch in diameter, depressed globular and shortly fulvous pubescent. Male cones rather loose, at the ends of long branchlets. Filaments rather long.

Habitat.—Of limited range in Victoria, near the Bogan, Lake Morton and the Murray River. Also in New South Wales and South Australia.

Timber.—Pale outside but duramen dark brown, tough and durable; or reddish with prominent medullary rays, but less figured than the other species of *Casuarina*. Useful for tool handles, sticks, shingles, staves and cabinet work, but usually too small for use as sawn timber. Forms good firewood. Extremely hard and somewhat brittle when dry. A cubic foot weighs 70 lb.

The foliage is used as a fodder standby in time of scarcity, but is astringent and contains 2½ per cent. of the dry weight of tannin. The tree is easily killed by ring-barking and is very apt to draw lightning, because its deeply penetrating roots usually maintain a connexion with underground water and because of its pointed foliage. The tree is of rapid growth but is apt to decay early at the centre. It does not sucker when ring-barked, and seedlings are eaten out by stock. It usually grows on low-lying flats, but also on hillsides or sandy rises.

Casuarina Luehmanni, R. T. Baker. "Buloke." (Plate XVI.)

Description.—This is a fair-sized tree attaining a maximum height of 70 feet to 80 feet, rarely more, and a diameter of 1 foot to 1½ feet. The bark is furrowed, brittle and easily removed. The branchlets are robust, light coloured and glaucous, with the teeth of the sheath nine to twelve in number with brown or black pointed tips. The flowers are dioecious. The male spikes are about 1 inch long and the flattened fruit cones are about ½ inch in diameter with three discoid rows of valves and usually only a few ripe seeds. The seeds are small, shining, dark brown and with a narrow wing.

Habitat.—A native of the North Western Districts and of the plains near the Brisbane Ranges and Parwan Creek. Also in the interior of New South Wales, Queensland and South Australia.

Plate XVII.—*Casuarina stricta.* The Drooping Sheoke.

A. Shoot with branchlets.
B. Leaf sheath opened out.
C. Fruit.
D. Male cone.
E. Stamen enlarged.
F. Young female inflorescence.

Plate XVIII.—*Casuarina suberosa.* The Black Sheoke.

A. Branch with young shoots and female inflorescences.
B. Branch with male flowers.
C. Ripe cones with dehiscing capsular fruits.
D. Winged seed.
E. Portion of branchlet showing whorled scale leaves at nodes.
F. Spike of male flowers in whorls.

Timber.—Hard, durable, close grained, fairly strong, and strikingly figured by the broad medullary rays. These are strongly lignified and impregnated with tannin so that they resist decay in the ground often longer than the rest of the wood tissue. It can be used for furniture, inlay work, veneers, cabinet work, heavy wagon parts. It stands well in the ground. A cubic foot weighs 68 to 70 lb. Too heavy for beams or planks but could be used for parquet flooring, although it is apt to wear unevenly.

The leaves and branches are used for fodder in time of scarcity, but are very binding when used alone.

Casuarina stricta, Ait. "Drooping Sheoke." (*C. quadrivalvis, Lab.*)
(Plate XVII.)

Description.—A small tree 20 feet to 30 feet high and up to 18 inches diameter, usually with pendulous branches, particularly in male trees, and nine to twelve leaves in each leaf sheath, each with a free pointed tip. Flowers dioecious. Male spikes often above 1 inch in diameter, sometimes as much as 2½ inches long and 1¾ inches diameter, and glabrous with prominently projecting valves.

Habitat.—This tree is widely distributed throughout Victoria (N.W., S.W., S., N.E., and E.) and occurs in fair amount near Portland and in the National Park at Wilson's Promontory as well as in some parts of Gippsland; also in New South Wales, Tasmania, South Australia and Western Australia. It is of quick growth, even on poor sandy soils along the coast, and resists exposure, wind and saline conditions.

Timber.—The wood is reddish brown, hard, close, tough and fairly heavy, just floating in water when well dried, but sinking when soaked. A cubic foot of the dry wood averages 58 to 64 lb. Tranverse breaking stress, 3 ft. x 3 in. x 3 in., 1,500 to 2,500 lb. On account of the grain and prominent dark medullary rays the timber is of use in cabinet work, furniture making and turnery. It is also used for shingles and staves, but does not usually last well in the ground, particularly if alternately wet and dry.

The timber, as in other Sheokes, yields a useful fuel, giving little flame and a glowing charcoal fire.

The branches are readily eaten by stock in time of scarcity. They are, however, acid and excite salivation when chewed. The plant is propagated readily from seed.

Casuarina suberosa, Otto & Dietrich. "Black Sheoke." (Plate XVIII.)

Description.—This is a tree of 20 feet to 40 feet in height and 1 foot to 2 feet in diameter, closely allied to and possibly a variety of *C. equisetifolia*. The whorls have six to eight parts and the flowers are often

Plate XIX.—*Nothofagus Cunninghami.*—The Myrtle Beech, and (B-E) *Fagus silvatica.*

A. Nothofagus Cunninghami.
B. Male flower, Fagus silvatica.
C. Female flowers in involucre and bracts.
D. Involucre open, showing two fruits (nuts).
E. Fruits enclosed in involucre.

monoecious. The corky surface of the old stems is rarely shown by the branchlets which are usually slender and quite glabrous.

The male spikes are slender and interrupted. Stamens in rings enclosed within the non-overlapping sheaths, the anthers projecting. The cones are usually cylindrical, truncate, and ½ inch in diameter, often becoming ovoid or oblong, and with prominent valves.

Habitat.—The tree grows at both low and upland elevations in the S.W., S., N.E., and E. It is fairly common along the Yarra River and in the Dandenong Ranges; also in New South Wales, Queensland, Tasmania and South Australia.

The branches have less fodder value than the other species. The old bark contains over 10 per cent. of tannin.

Timber.—Somewhat similar to the preceding in properties and uses, but is darker, more durable, and can also be used for veneers, mauls and tool handles, and was formerly used by the blacks for boomerangs. When air dry a cubic foot weighs about 56 lb. It forms good fuel. As it splits well it has been used for shingles. It seeds freely and is easily grown from seed.

FAGACEAE.

This order, formerly included under *Cupuliferae*, is represented by the Chestnuts, Oaks, and Beeches (*Fagus*, *Nothofagus*). The European genus *Fagus* is represented in Victoria by a single species only, *Nothofagus Cunninghami*, which corresponds in the Southern Hemisphere to the European beech of the Northern Hemisphere. The order includes five genera and about 550 species, mainly of temperate regions. Woody plants with deciduous stipules, with unisexual flowers usually in catkins. Perianth four to seven partite, stamens the same or twice as many. Ovary tricarpellary. Fruit, one-seeded with a cupule.

NOTHOFAGUS.

Nothofagus Cunninghami, Orst (Hook), " The Myrtle Beech."
(Plate XIX.)

Description.—It is a large tree attaining a total height of 50 feet to 100 feet, or even more in valleys and rich slopes, and sometimes a diameter of 5 feet to 6 feet, but more usually 2 feet to 3 feet. A good trunk will have a length of 40 feet and a diameter of 2 feet to 4 feet. On very high mountain elevations in exposed situations it is reduced to a dense shrub. The leaves are evergreen, very shortly stalked, and from ovate to orbicular or deltoid rhomboid in shape, and usually ¼ inch to ½ inch long. The membranous stipules soon fall.

The male flowers are solitary and on short stalks in the lower axils or small axillary branchlets. The perianth is six-lobed, stamens about eight, the oblong anthers longer than the filaments. The female flowers occur in threes in the upper axils, each group with an involucre. The nuts usually occur in threes, two with three wings and a central one with two wings.

Nothofagus was formerly included under *Fagus*. The male flowers are similar, but in *Nothofagus* occur singly (or in threes) in the axils of the leaves, whereas in *Fagus* they occur in small clusters. The female flowers occur three to each involucre in *Nothofagus*, but only two in *Fagus*. The fruits are nut-like and enclosed by the involucre.

Habitat.—The Myrtle Beech grows along the Upper Yarra, on the Baw Baw Mountains, at Cape Otway and on Wilson's Promontory; also in Tasmania. It prefers moist sheltered localities and ascends to 3,000 or 4,000 feet, then becoming a shrub. Large quantities of this valuable tree have been destroyed by fire and axe, and as it appears to be of slow growth, natural regeneration is not very effective. The seeds are of short duration, rarely germinating after the first year.

Timber.—The older wood is reddish coloured, fading to a paler brown in shade on seasoning. It shows a beautiful figure and grain and takes a high polish. The young, rapidly-grown wood is pale or white and soft. The timber seasons well, and becomes very strong and tough. Hence it has been used for the cogs of wheels by millwrights, for which purposes the wood can be hardened by dipping in hot oil. When air-dry it floats freely, and has a specific gravity of 0.8 to 0.88, a cubic foot weighing about 47 lb. to 55 lb. It is especially valuable for furniture making, for doors and the sashes of windows, and for ship fittings, turnery, staves, felloes, skirting, floor boards, &c. It planes well and wears smoothly. It is close-grained and stronger than European beech. A rod 6 feet long and 1⅞ inches square breaks with a weight of 550 lb. to 690 lb. applied at the middle. Transverse breaking stress of 3 feet x 3 inches x 3 inches averages 5,000 lb., 1 foot x 1 inch x 1 inch 1,000 lb.

ULMACEAE.

An order of trees and shrubs widely distributed, but poorly represented in Southern and Western Australia.

Flowers usually unisexual by abortion. Perianth four to five partite, rarely more or less. Stamens the same, or rarely twice as many. Ovary bicarpellary, but usually only one chamber develops. Fruit a one-seeded achene or drupe, with a peripheral wing in the elm. The bark is rich in tannin and the wood strong and durable. That of the elm is preferred by connoisseurs for coffins. The order includes thirteen genera and about 130 species.

BOTANIC GARDEN DOMAIN

Plate XX.—*Trema aspera.* The Hemp Nettle.

A. Branch with leaves and flowers.
B. Flower, seen from above.
C. Flower, seen from beneath.
D. Side view of fruit.
E. Transverse section of fruit
F. Embryo.
G. Pollen grains.

Although various Elms are widely planted in Victoria there are no native trees belonging to this order, with the exception of *Trema aspera*, which sometimes attains the dimensions of a small tree. *Trema* is mainly a tropical genus of about 30 species of shrubs and trees.

TREMA.

Trema aspera, Blume. " The Hemp Nettle." (Plate XX.)

Description.—This forms a shrub or slender tree 10 feet to 20 feet high, rarely attaining a height of 50 feet, and a diameter of 1 foot to 2 feet, with pubescent branches. The leaves are usually ovate-lanceolate and acuminate, serrate-crenate and green, and scabrous on both sides or white tomentose beneath. The small flowers are sessile or shortly stalked in short cymes sometimes wholly of male flowers, but more usually with a few female or hermaphrodite ones. The male perianth is barely a line in diameter when expanded, and the female is still smaller. Perianth four or five partite. Each male or hermaphrodite flower has four or five stamens. The fruit is a small ovoid drupe, between one and three-quarters and two lines in length.

In New South Wales this plant has long been reputed poisonous under the name of Peach-leaved Poison-bush. No poisonous principle has been extracted, and direct poisoning experiments have been negative. The fibrous bark, however, can readily cause obstruction and impaction in the alimentary canal of ruminants. The bark yields a fairly strong fibre, formerly used by the natives, and hence the native name " Kurrajong," usually given to a fibre plant.

Timber.—Though only a small tree the timber is hard, tough, close-grained, and durable, and is useful for turnery and cabinet work when obtained in sufficient size. It also yields a good charcoal.

Habitat.—In Victoria the plant is native to Gippsland only, but it extends up to New South Wales, Queensland, and North Australia, where usually it attains a larger size than in Victoria.

MORACEAE.

An order of trees or shrubs, rarely herbs, mainly tropical, but a few forms extending to temperate Europe, Asia, and Australia. It includes 55 genera and about 900 species, of which some 600 are included under Ficus (Fig, Banyan, Assam Rubber). Among members of the order are: the Hop (*Humulus*), Hemp (*Cannabis*) yielding fibre and the drugs Bhang and Hashish, the curious Ant Plant (*Cecropia*), the poisonous Upas Tree (*Antiaris toxicaria*), Mexican and West Indian rubber (latex of *Castilloa*), the Bread-fruit tree (*Artocarpus*), and the Mulberry (*Morus*).

Plate XXI.—*Ficus scabra.* The Sand-paper Fig (A). *Ficus diversifolia* (B-E).

A. Branch with young fruits of *Ficus scabra.*
B. Male flower.
C. Female flower.
D. Fruit in section.
E. Young fruit in flowering stage in section.

It is an order of great economic importance, yielding rubber, edible fruits, fibres, yellow pigments (*Maclura*), food for silkworms, and in some cases valuable timber. The wood is usually soft and not very durable, and the soft bark contains milk tubes, yielding a more or less abundant flow of latex.

Flowers unisexual, usually with a regular persistent perianth. Perianth usually four partite, and stamens the same or less. The segments usually enlarge or become fleshy in the female flowers. Ovary one-chambered, and one-seeded with one or two styles. Fruit usually a small drupel or nutlet, often clustered on a fleshy axis (Mulberry) or in a hollow receptacle, as in the Fig.

Only one indigenous plant belonging to this order attains the dimensions of a tree.

Ficus scabra, G. Forster. "Sand-paper Fig." (Plate XXI.)

Description.—It is a tree attaining a maximum height of 80 feet to 100 feet, but usually much smaller. The tree is only partially evergreen. The leaves are alternate, mostly narrow, elliptical and shortly pointed, 3 inches to 6 inches long, rough, with stiff hairs beneath. The edge may be entire, toothed, or even deeply lobed. The stalks are short. The young receptacle which encloses both male and female flowers, and develops into the "fruit" is 4 inches to 6 inches long, rough with dense hairs, and with a row of projecting bracts around the rather broad mouth. The stamens are two to four in each male flower, and the anther cells are parallel. The style is glabrous with a terminal truncate or slightly peltate stigma. The small fruits resemble seeds. They are short-lived, often sterile, and usually fail to germinate after the first year.

Timber.—Not very strong and is not durable. It can be slowly dried without cracking much, but when dry is brittle and of a rather unpleasant yellowish colour. The rough leaves are used by the natives as a substitute for sandpaper, and the fruit is also eaten by them. The wood forms a low-grade fuel and appears to have no other use.

Habitat.—Found at Genoa River; also in New South Wales, Queensland and North Australia.

PROTEACEAE.

Although this genus is mainly restricted to Australia (270 species) to which many genera are in fact endemic, a few representatives extend to Africa and mainly South Africa, while some even extend to South America, Tropical East Asia, New Zealand and New Caledonia. It contains few plants of economic value and most of the species are small or medium-sized shrubs. A few representatives form large trees, but

Plate XXII.—*Persoonia lanceolata*. The Bonewood.

A. Twig with young fruits.
B. Twig with flowers.
C. Flower.
D. Stamen attached to perianth.
E. Gynaeceum.

Plate XXIII.—*Persoonia rigida.* The Hairy Geebung.

A. Flowering branch.
B. Fruit.
C. Flower.
D. Fruit of *P. ferruginea*, portion of pericarp removed to show the stone which encloses the seed.

for the most part these are not of great value for timber. Many, however, are handsome flowering trees well adapted for ornamental plantations, while nearly all are rich honey yielders, and hence of value to apiarists.

The order includes 50 genera and over 100 species, mainly in *Persoonia Grevillea*, *Hakea*, *Protea*, *Leucadendron*, *Banksia* and *Dryandra*. Flowers hermaphrodite, rarely unisexual by abortion. Perianth inferior, petaloid, four partite often tubular, with the lobes separating or bending back when the flower opens. Stamens four, the filaments usually more or less fused to the perianth segments. Anthers free, erect opening by introrse longitudinal slits. Ovary sessile, or stalked, superior, of one carpel, seed single, or several in two rows. Ovules usually anatropal. Style with a globular or oblique and plate-like stigma. Fruit a dehiscent capsule or follicle, or an indehiscent stone fruit or nut.

Shrubs and trees, very rarely herbs, usually with spirally arranged more or less leathery leaves, subdivided or entire without stipules. The flowers often clustered in large spikes or heads.

PERSOONIA.

A genus of about 60 Australian and 1 New Zealand species. Although a dicotyledon, the seedling has three to eight cotyledons. Shrubs or small trees with yellow or white flowers. The fruit is a stalked drupe with one chamber and one seed, or with two one-seeded chambers. Perianth cylindrical or narrowed above, the segments finally more or less free and bent back. Filaments at least half united to perianth ; sometimes one anther sterile.

The yellow flowers of *P. saccata* yield a yellow dye. The seeds are short-lived, rarely germinating well when more than two years old.

Persoonia lanceolata, Andrews. " The Bonewood." (Plate XXII.)

Description.—This is an erect shrub, attaining a height of 10 feet to 15 feet. The leaves are 1½ inch to 2½ inches long and lanceolate on short petioles. The flowers are solitary or in pairs on very short stalks in the axils of the leaves. The perianth is about five lines long, there are four stamens, the ovary is glabrous and the style elongated. The ovules are two in number and the seed has four to five cotyledons. The fruit is a large drupe.

Habitat.—A native of Gippsland and East Victoria.

Timber.—Pale, hard, but too small to be of economic value.

Persoonia rigida, R.Br. " Hairy Geebung." (Plate XXIII.)

Description.—This is a shrub attaining a maximum height of 10 feet to 15 feet. The leaves are ½ inch to 1½ inches long. The flowers are mostly nearly sessile or shortly stalked and solitary in the axils. The perianth is five to six lines long, the stamens four in number. The ovary is stalked, the style elongated and the ovules two in number. The broadly globular fruit is about ½ inch long.

Plate XXIV.—*Persoonia arborea.* The Tree Geebung
Branch with leaves, and a ripe fruit.

Plate XXV.—*Persoonia linearis.* The Narrrow-leaved Geebung.

A. Leafy branch with fruits.
B. Flowering branch.
C. Flower.
D. Fruit.
E. Young fruit after perianth has fallen.

Plate XXVI. *Hakea leucoptera.* The Needle Hakea.

A. Flowering branch.
B. Closed flower.
C. Opening flower.
D. Expanded flower, showing (*a*) four parts to perianth, (*b*) style, (*c*) stigma.
E. Centre of flower, showing (*a*) hypogynous gland, (*b*) stalked ovary, (*c*) style, (*d*) stigma.
F. Anther.
G. Stigmatic disc.
H. Branch with fruits.
I. Winged seed.

Habitat.—A native of North-Eastern Victoria (Buffalo Ranges, Mount Alexander, Forest Creek, Broken and King Rivers); also New South Wales.

Timber.—As above.

Persoonia arborea, F.v.M. "The Tree Geebung." (Plate XXIV.)

Description.—It is a tree up to about 30 feet in height, with shortly stalked oblong lanceolate leaves, usually 2 to 4 inches long, and slightly hairy beneath. The young shoots are usually hoary, with short hairs forming a white or brownish covering. The flowers are solitary in the axils of the leaves on short pedicels, one to two lines long. The perianth is prominent, and is split into segments thickened at the tip. The fuit is small, globular pointed, and with one or two seeds.

Habitat.—It is a native of the North and North-East of Victoria, often accompanying the native beech as from Toolangi to the Baw Baw mountains. It usually grows at moderate elevations in moist shady woods, as at the sources of the Latrobe, Tarwin, Tyers, and Yarra rivers.

Timber.—The wood is pale, hard and tough, but it appears to be slow in growth and is too scarce to be of much economic use. It is stated to have been used by the aborigines for spear shafts and tools.

Persoonia linearis, Andrews. "The Narrow-leaved Geebung." (Plate XXV.)

Description.—This is a tall shrub, often attaining the dimensions of a tree 15 feet to 20 feet high. The leaves are linear and pointed, 1 inch to 2 inches long and $\frac{3}{4}$ to $1\frac{1}{2}$ lines broad. The flowers are solitary on stalks 1 inch to 3 inches long, with a perianth about 5 lines long and four stamens. The ovary is glabrous and stalked. The style is long and the ovules are two in number. The fruit is an ovoid, or ovoid-globular, drupe.

Habitat.—A native of the East of Victoria (Geneva and Snowy Rivers and Wangatta Mountains); also in new South Wales and Queensland.

Timber.—Too small to be of economic value.

HAKEA.

An entirely Australian genus, represented by over 100 species. The leaves are usually more or less needle-like and simple or compound, whereas many species of Grevillea have flat compound leaves. The fruit in Hakea is hard and woody, splitting into two pieces with the seed between, whereas in Grevillea the fruit is hollow and capsular, although it sometimes splits longitudinally as in Hakea. The seeds in Grevillea have no wing or only a narrow one, whereas in Hakea the wing is large at the upper end of the seed. Although many species are of decorative value, few are of importance so far as their timber is concerned.

Flowers usually in pairs in dense axillary racemes or small clusters. Perianth tubular, broad at the top and splitting into segments. Ovary shortly stalked with a plate-like or conical end to the style. Fruit a

Plate XXVII.—*Hakea vittata.* The Striped Hakea.

A. Flowering shoot.
B. Fruits.
C. Open flower.
D. Flower openings.
E. Open fruit.

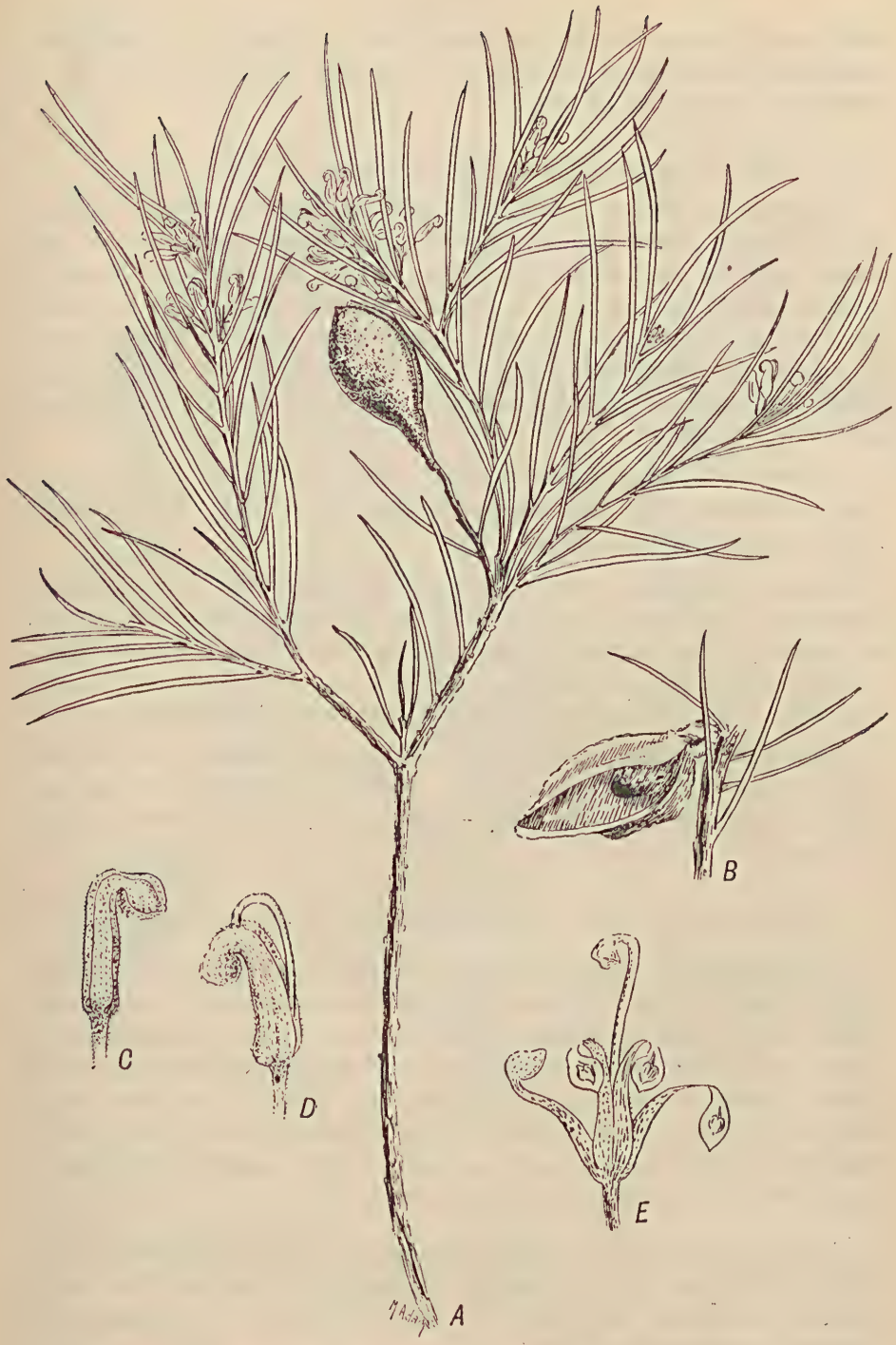


Plate XXVIII.—*Hakea nodosa.* The Yellow Hakea.

A. Leaf shoot with flowers and fruit.
B. Dehiscing fruit.
C. Unopened.
D. Opening flower.
E. Fully expanded flower.

hard woody capsule with two winged seeds. Though not hard, the seeds may last for five to ten years. A ten year old sample of *H. cyclo-ptera* gave 60 per cent. germination.

Hakea leucoptera, R.Br. "Needle Hakea." (Plate XXVI.)

Description.—This is little more than a shrub up to 12 feet or 15 feet in height with rather slender virgate branches and pointed needle-like leaves 1½ inches to 3 inches long. The flowers are small and in short racemes on stalks 2 lines to 2½ lines long. The perianth is glabrous, the tube 2½ lines long, and with four stamens. Gland semi-annnlar. The ovary is stalked with a short style and very oblique stigma. The woody fruit is about 1 inch long and ½ inch to ¾ inch broad. Seed winged on the upper end.

Habitat.—A native of North-Western Victoria (Murray Desert, Lake Morton, Jeparit, &c.), also in Queensland, New South Wales, South Australia and North Australia.

Timber.—Reddish brown, hard, tough, close-grained. May be useful for turnery, carving and small articles, but too small to be of any general importance. Good tobacco pipes may be made from the root stock. The medullary rays are small, somewhat silvery, and give a good figure. The wood contains a resinous gum. A cubic foot weighs 50 to 55 lb.

Starving sheep will eat the needle leaves, but they are poor fodder. After burning back the plant, drops of water will exude from the cut roots if placed on end. The blacks obtained water in this way in dry districts.

Hakea vittata, R.Br. "Striped Hakea." (Plate XXVII.)

Description.—A shrub or small tree, sometimes attaining a height of 15 feet to 20 feet and a diameter of 6 inches to 9 inches. Young shoots with minute white or brown deciduous hairs. Leaves needle-like 1½ inches to 3 inches long. Flowers in small stalked axillary racemes or heads. Perianth glabrous, splitting on one side as the curved style elongates. Stigmatic disc lateral, with a central cone. Fruit ovoid, slightly pointed, about ¾ inch long, with a dark band or stripe along each suture. Seed winged on the upper end.

Habitat.—A native of North-Western and South-Western Victoria, in the Mallee and on the Buffalo Mountains. Also in New South Wales, Queensland and South Australia, usually in dry localities on poor soils and sandy plains.

Timber.—Reddish brown, hard and tough; can be used for turnery and cabinet work, but too small to be of much economic value. The root stock can be used for tobacco pipes. In dry districts where wood is scarce it is sometimes useful for firewood but is slow in growth and not worth planting for this purpose.

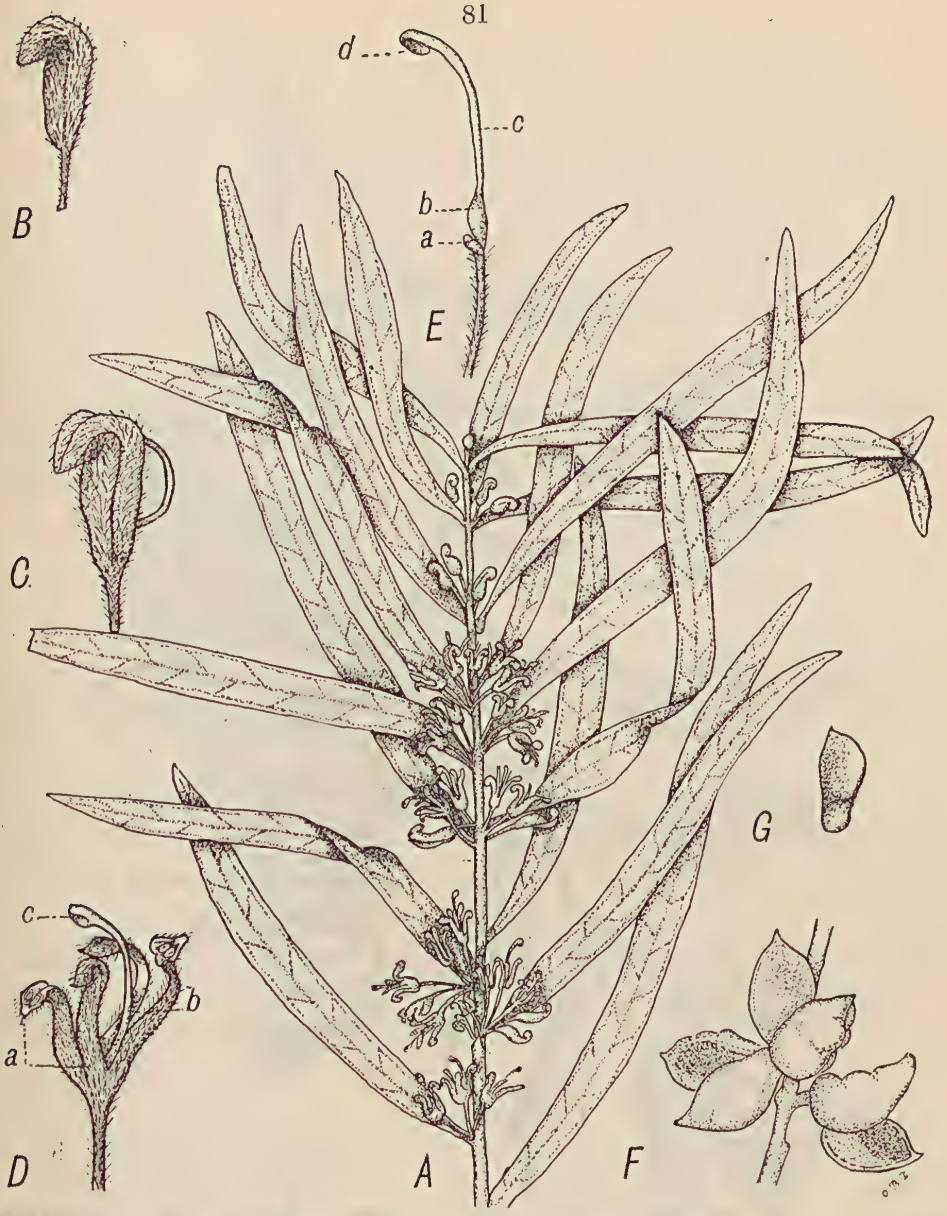


Plate XXIX.—*Hakea eriantha.* The Tree Hakea.

A. Flowering twig.
B. Bud.
C. Unopened flower.
D. Opened flower, showing—
   (*a*) Four-lobed corolla, the laminæ with acute recurved points, with sessile anthers in the concave laminæ.
   (*b*) Style.
   (*c*) Stigma.
E. Portion of flower (corolla removed) showing—
   (*a*) Hypogynous gland.
   (*b*) Stipitate ovary.
   (*c*) Style.
   (*d*) Stigma.
F. Fruits.
G. Seed.

Plate XXX.—*Grevillea robusta.* The Silky Oak.

A. Inflorescence and compound leaf.
B. Fruit.
C. Flower, showing style, stigma, and perianth segments with anthers.

Hakea nodosa, R.Br. "Yellow Hakea." (Plate XXVIII.)

Description.—This is usually a shrub of 10 feet or 12 feet, but may attain the dimensions of a small tree up to 20 feet high. The leaves are 1 inch to 2 inches long, narrow, linear and pointed. The flowers are small, in axillary clusters and on pedicels scarcely a line long. The perianth is glabrous or nearly so, with four stamens. The ovary is shortly stalked and the style short. The woody fruit is $\frac{3}{4}$ inch to nearly 1 inch long and $\frac{1}{2}$ inch broad.

Habitat.—A native of South-Western and South-Eastern Victoria (Port Phillip, heaths near Bridgewater Bay and Portland; marshy pastures from Dandenong Creek to Gippsland); also South Australia and Tasmania.

Timber.—Too small to be of economic value.

Hakea eriantha, R.Br. "Tree Hakea." (Plate XXIX.)

Description.—A tall shrub or small tree, 10 feet to 20 feet high, with leaves 3 inches to 5 inches long, lanceolate and tapering to a blunt point. The flowers are in axillary clusters, are not numerous, and are on silky hairy stalks about 1 to 2 lines long. The perianth is silky and the tube 3 lines long with four stamens. Gland prominent and semiannular. The ovary is shortly stalked with a rather short style and a rather large lateral stigmatic disc. The woody fruit is about an inch long and half an inch broad. Seed with a terminal wing.

Habitat.—A native of North-Western and Eastern Victoria (Tambo and Mitta Mitta to Genoa River); also in New South Wales and Queensland. Usually on cold exposed localities.

Timber.—Pale, tough and useful for tool handles, but too small to yield timber.

GREVILLEA.

A large Australian genus of nearly 200 species, including both trees and shrubs. Perianth tubular, expanded at the top, splitting in segments each with one stamen. Ovary sessile or stalked. Style with a conical or discoid extremity. Fruit hollow, two-seeded, splitting at the top or into two valves. Flowers in pairs, in racemes or clusters, rarely reduced to a single pair.

Grevillea robusta, A. Gunn. "Silky Oak." (Plate XXX.)

Description.—A tall tree attaining a height of 50 feet to over 100 feet with large flat compound pinnate leaves, and covered when in flower with more or less unilateral racemes of brownish red flowers developed on the older wood. Corolla tube splitting into segments each with a small, short sessile stamen at its apex. Gland prominent and semiannular. Ovary stalked with a long style and a conical stigma. Fruit a stalked follicle less than an inch long with one or two winged seeds.

Plate XXXI.—*Telopea oreades*. The Gippsland Waratah.

A. Flowering shoot.
B. Flower bud.
C. Bud more advanced.
D and E. Front and back views of opened flower.
F. Side view of same.
G. Pistil, showing—
  (*a*) Stipitate ovary.
  (*b*) Style.
  (*c*) Stigma.
  (*d*) Hypogynous gland.
  (*e*) Pedicel.
  The stipes is just above (*d*) and is not indicated by a letter.
H. Anthers (*a*) sessile at the base of the laminæ.
K. Follicle.
L. Winged seed.
M. and N. Broader and narrower leaves.
N. Leaf from Gippsland, Victoria.

Habitat.—Native to New South Wales and Queensland. (Cultivated in Victoria.) It is resistant to drought but not to frost and will grow fairly well in comparatively dry districts. The growth is rapid and the flowers yield an abundance of honey. The seeds are short-lived, rarely germinating well after the second year.

Timber.—The wood is strong and durable and can be used for staves of barrels for beer, wine, &c., but is less suitable, owing to its porosity, for spirit casks. It is pale brown or reddish brown, with a greyish white sap-wood, has a figure resembling oak, and is readily fissile and works well. A cubic foot weighs, when well-seasoned, 36 lb. to 40 lb. Under good conditions the tree is of rapid growth and may attain a diameter of 2 feet to 3 feet in 50 years, after which it usually begins to decay.

Honey.—The tree flowers profusely in early summer, and yields an abundant and palatable honey. The flowering period is short, rarely extending over more than three weeks. The tree is readily grown from seed, which is, however, troublesome to collect in any quantity.

TELOPEA.

A small genus of three species confined to South-Eastern Australia and including the New South Wales Waratah, with its large coloured clusters of flowers surrounded by large persistent bracts. Perianth tubular, splitting into segments at the top. Ovary narrow, stalked with the end of the style wedge-shaped. Fruit a leathery follicle.

Telopea oreades, F.v.M. "Gippsland Waratah." (Plate XXXI.)

Description.—This is a small tree sometimes attaining a height of 30 feet to 40 feet and a diameter of 1½ feet to 2 feet. The leaves are lanceolate and glabrous, up to 4 inches to 8 inches long, tapering into a long petiole. The crimson flowers are arranged in a dense ovoid or globular head or raceme. There are four stamens. The corolla splits on one side. The fruit is 2 inches to 3 inches long, is stalked, and has a persistent style.

Habitat.—The tree is often cultivated and grows wild in Gippsland, particularly on the Wangatta Mountains and Cann River. Also on the south coast of New South Wales.

Timber.—Light brown, moderately hard, with a beautiful figure, and grain somewhat resembling the best American Sycamore. It polishes and works well, is tough and elastic, and is useful for furniture, veneers, tool handles and picture frames. A cubic foot weighs 45 lb.

LOMATIA.

A genus of nine species of shrubs or trees, six species in East Australia and three in Chile. Perianth tube oblique, split on the back, with short,

Plate XXXII.—*Lomatia longifolia.* The Long-leaved Lomatia.

A. Branch with leaves and fruits.
B. Leaf and axillary inflorescence.
C. Open.
D. Opening flower with curved style and stigma still enclosed by the tip of the perianth.

Plate XXXIII.—*Lomatia ilicifolia.* The Holly Lomatia.

A. Leaves.
B. Fruits.
C. Flowers.

Plate XXXIV.—*Lomatia Fraseri.* The Tree Lomatia.

A. Branch with leaves and dehiscing fruits.

B. Inflorescence and flowers.

C. Single flower.

free segments. Ovary stalked, the end of the style forming an oblique. disc with a small central stigma. Follicle leathery, broad and flat. The seeds are short-lived, rarely germinating well after the second year.

Lomatia longifolia, R.Br. " The Long-leaved Lomatia." (Plate XXXII.)

Description.—This is more an erect shrub than a tree, but may attain a height of 10 feet to 15 feet. The plant is glabrous or slightly ferruginous. The leaves are 4 inches to 8 inches long, linear to lanceolate, more or less toothed. The pale yellow flowers are grouped on axillary and terminal racemes. The glabrous perianth is 4 lines to 5 lines long and has four stamens. The fruit is about an inch long, and is a stalked follicle.

Habitat.—It grows in the South, North-East and East of Victoria (King River, Mitta Mitta, Buffalo Ranges, &c.), also in New South Wales.

Timber.—Too small to be of economic value. Good sticks can sometimes be obtained from it.

Lomatia ilicifolia, R.Br. " Holly Lomatia." (Plate XXXIII.)

Description.—An erect branching shrub, sometimes growing out into a small tree 15 feet to 20 feet high. The leaves are 2 inches to 6 inches long, ovate-lanceolate with a toothed margin. The flowers are in loose racemes on stalks $\frac{1}{4}$ inch to $\frac{1}{2}$ inch long. The perianth is glabrous or hairy and encloses four stamens. The fruit is a broad follicle 1 inch to $1\frac{1}{2}$ inches long.

Habitat.—The plant grows in the South, North-East and East of Victoria. Detailed localities are Port Phillip, Wilson's Promontory, and Sealers' Cove, Dandenong Ranges, Mount Disappointment, Bunyip Creek, Mount Aberdeen, Delatite Mountains; also in New South Wales.

Timber.—Too small to be of much economic value except for turnery and cabinet work, walking sticks, &c.

Lomatia Fraseri, R.Br. " The Tree Lomatia." (Plate XXXIV.)

Description.—A tall shrub or small tree attaining a height of 15 feet to 25 feet or even more. The leaves are 2 inches to 6 inches long, narrow entire, or slightly toothed or indented with shining appressed hairs on the under side. The flowers are hairy outside and with four stamens. The inflorescence is a long stalked raceme. The ovary is glabrous and forms a flattened, follicular fruit 1 inch to $1\frac{1}{2}$ inches long.

Habitat.—The plant is a native to the South, North-East and East of Victoria (Dandenong Ranges and Gippsland); also in New South Wales and Queensland.

Timber.—This is usually the largest of the Lomatias, but the timber is rather small and of little use except for cabinet work or small furniture

BOTANIC & DOMAIN GARDENS

Plate XXXV.—*Banksia serrata.* The Saw Banksia.

A. Portion of the cylindrical flowering spike.
B. A single flower expanded, showing the perianth segments (*a*) and the style (*b*).
C. Back and front view of the tip of perianth segments showing the stamen (*a*).
D. Carpel showing ovary (*a*), style (*b*), and stigma (*c*).
I. Stigma, enlarged.
J. Fruiting cone, with projecting capsules.
K. Contents of fruit, showing the septum (*a*), separating the two winged seeds (*b*, *b*).
L. Leaf.

BANKSIA.

A genus of nearly 50 species of trees and shrubs endemic to Australia, with the exception of *B. dentata* which also extends to Papua, and represented in all the States.

The flowers are grouped in large dense spikes forming thick woody cones when ripe. Perianth slender, tubular, broader and oval at the top where the anthers are enclosed, and splitting into four segments. Ovary narrow, sessile, with a long style and a small terminal stigma. Capsule compressed, splitting by two woody valves and with one or two seeds, each with a short broad terminal rounded wing. The seeds may be retained in the capsule for over a year and appear to have an average duration of four to five years. The Banksias are of slow growth with a thick, very rough bark, and, when trees, have a short, stout, often gnarled or twisted stem. They stand considerable exposure to wind and grow on poor soils.

Banksia serrata, L. "Saw Banksia." (Plate XXXV.)

Description.—A tree 20 feet to 30 feet high or rarely up to 50 feet with a diameter of 3 feet, with stout, rough stems and gnarled branches, as also in the following species. Young shoots with brown deciduous hairs. The leaves are 3 inches to 6 inches long and ½ inch to 1 inch broad, tapering at the base into a stalk, with serrate margins, hairy beneath and rather thick and leathery. The flowers are in large, dense oblong-cylindrical or rarely globular spikes, 3 inches to 6 inches long and very thick. The perianth is shortly silky, the tube about 1 inch long, splitting into four segments each with an anther attached. Style at first bent, later straightening with a cylindrical, somewhat furrowed, stigmatic end half a line long. Fruiting cone with hard, woody capsules about an inch long, opening apically in valves.

Habitat.—A native of the East of Victoria, Port Albert, Wilson's Promontory, Gippsland (Buchan River, &c.); also in New South Wales and Tasmania. It usually grows in poor, sandy soils, near the sea coast. Where much exposed, it is usually dwarfed.

Timber.—Hard and red to reddish brown. Used for boat knees, bullock yokes, wooden screws and turnery. A cubic foot weighs 40 lb. to 45 lb. The actual wood tissue is hard but the medullary rays are large. These make it less durable and liable to the attacks of borer beetles, but give it a striking figure and make the wood useful for furniture and veneers. It forms good firewood. The fleshy and reddish inner bark contains 10 per cent. to 20 per cent. tannin.

Honey.—Rather strongly flavoured and candies quickly. The flowers are used for both nectar and pollen and the yield is high. Flowering takes place in December and January. The aborigines soaked the flowering cones in water to obtain a dilute, sugary beverage known as "beal." The same applies to other Banksias.

Plate XXXVI.—*Banksia integrifolia.* The Coast Banksia.

A. Leafy shoot with young cone.
B. Cone in flower.
C. Single flower expanded, showing perianth segments (*a*), ovary (*b*), style (*c*), and stigma (*d*).
D. Single carpel.
E. Corolla lobe—
   (*e*) Back view.
   (*f*) Showing stamen.
F. Fruiting spike, showing the prominent capsules (*g*).
G. Showing the toothed margin of the leaf often seen in this species.

Plate XXXVII.—*Banksia marginata.* The Silver Banksia.

A. Branch with flowering spike.
B. Unopened flower.
C. Opened flower showing—
   (*a*) Four-lobed corolla with stamens.
   (*b*) Pistil.
D. Corolla lobes—
   (*a*) With stamen (sessile anther) on the concave lamina.
   (*b*) Back view.
E. Fruiting cone, with ripe and with dehisced capsules.

Banksia integrifolia, L. " Coast Banksia." (Plate XXXVI.)

Description.—A tree growing to a height of 30 feet to 40 feet and a diameter of 2 feet to 4 feet and often attaining a considerable size. Leaves alternate, shortly stalked, oblong cuneate to lanceolate, 3 inches to 4 inches long, and up to an inch or ½ inch broad, and with the margins usually entire. Spikes oblong or cylindrical 3 inches to 6 inches long and with the bracts hairy at their ends. The perianth is usually about an inch long, and silky. The oblong or cylindrical cone has the capsules very prominent. Each cone only develops a few ripe capsules, which shed their seed when warmed. The seeds germinate readily and natural regeneration is easy.

Habitat.—A native of the South-West and South-East of Victoria (Sealers' Cove, Port Phillip and the Grampian Mountains). In the early days it was abundant along the coast from Port Melbourne to Brighton; also found in New South Wales and Queensland.

Timber.—Pinkish, with a prominent grain. A cubic foot averages 45 lb. Useful for furniture and veneers, also for ribs and knees in boat-building, for bullock yokes, &c.

Honey.—Highly coloured and with a strong aromatic flavour. Candies quickly and hard. Bees use both nectar and pollen, and flowering takes place in summer.

It is extremely unfortunate that the name " Honeysuckle " has been so widely used for Banksia, which bears about as much resemblance to the true garden honeysuckle (*Lonicera*) as a pea does to a turnip.

Banksia marginata, Cav. " Silver Banksia." (Plate XXXVII.)

Description.—It is usually a bushy shrub, but sometimes grows into a tree 20 feet to 30 feet high and over a foot in diameter. The leaves are 1 inch to 2 inches long, very shortly stalked and silvery beneath, usually entire or with a serrate edge, margin recurved, and tips blunt. The spikes are 2 inches to 4 inches long and oblong-cylindrical, and occasionally smaller and globular. The perianth is silky and little over half an inch long. The fruiting cone is oblong-cylindrical, with prominent capsules half an inch broad, and hairy when young.

Habitat.—A native of South, North-East, and East of Victoria (Port Phillip, Dandenong Ranges, Glenelg River, &c.); also in New South Wales, South Australia and Tasmania. It grows both in mountainous and coastal regions; owing to its compact habit it is a useful shelter tree.

Timber.—Soft, spongy and reddish, mottled when fresh, light when dry (a cubic foot weighs 38 lb. dry and about 42 lb. when air-seasoned). Useful for furniture and veneers.

Honey.—Strongly flavoured and candies quickly. Flowering takes place from February to May, or from April to July, according to the district. Bees visit the plant both for pollen and nectar. In the bud the stigma is pressed against the pollen, but, as it does not become receptive until the flower opens, cross pollination usually occurs and only in a small proportion of the flowers. The natives used the flowers for the production of the beverage "beal."

LORANTHACEAE.

An order of parasitic shrubby plants very common on trees and injurious, although usually possessing green leaves, and parasitic mainly for water and mineral salts. They mostly have no rooted attachment to the soil, but the Western Australian *Nuytsia floribunda* is a tree 30 feet to 40 feet high whose roots are parasitic on those of neighbouring plants and will even attack root-crops such as carrots, &c.

A small order of 22 genera and about 550 species, of which 200 belong to *Loranthus*. Mainly tropical but well represented in Australia. The berries of the Mistletoe are used in the preparation of bird-lime.

Flowers hermaphrodite or unisexual. Perianth 2 + 2, 2 + 3, or 3 + 3, segments, united or free, more or less petaloid. Stamens free or united to the perianth and equal in number to its segments. Ovary more or less sunk in the thalamus without a definite cavity or placenta, but with one to three embryo sacs of which one usually forms a seed enclosed by a berry-like or drupaceous fruit. Seedlings usually with two, sometimes with three to six cotyledons. The seeds germinate directly and do not stand severe drying.

LORANTHUS.

(Plate XXXVIII.)

Flowers hermaphrodite or unisexual by abortion. Calyx rim feebly developed or absent. Perianth of four to six petals, free or united more or less basally, the tube often split at the back. Stamens united to the petals, only at the base, or higher up, usually four. Style elongated with blunt or globular stigma. Fruit berry-like with a viscous outer layer and a single endospermic seed. Usually parasitic on Dicotyledons, rarely on Conifers. The sticky seeds are carried from tree to tree largely by the mistletoe bird, but also on the feet of opossums. Timber infested by the Mistletoe has its annual increment of wood greatly reduced, but the trees are rarely killed outright.

Petals free .. .. (1)

Petals united to the middle or higher up .. .. (5)

(1) Anthers versatile. *L. celastroides.*

Anthers adnate to the filament .. .. .. (2)

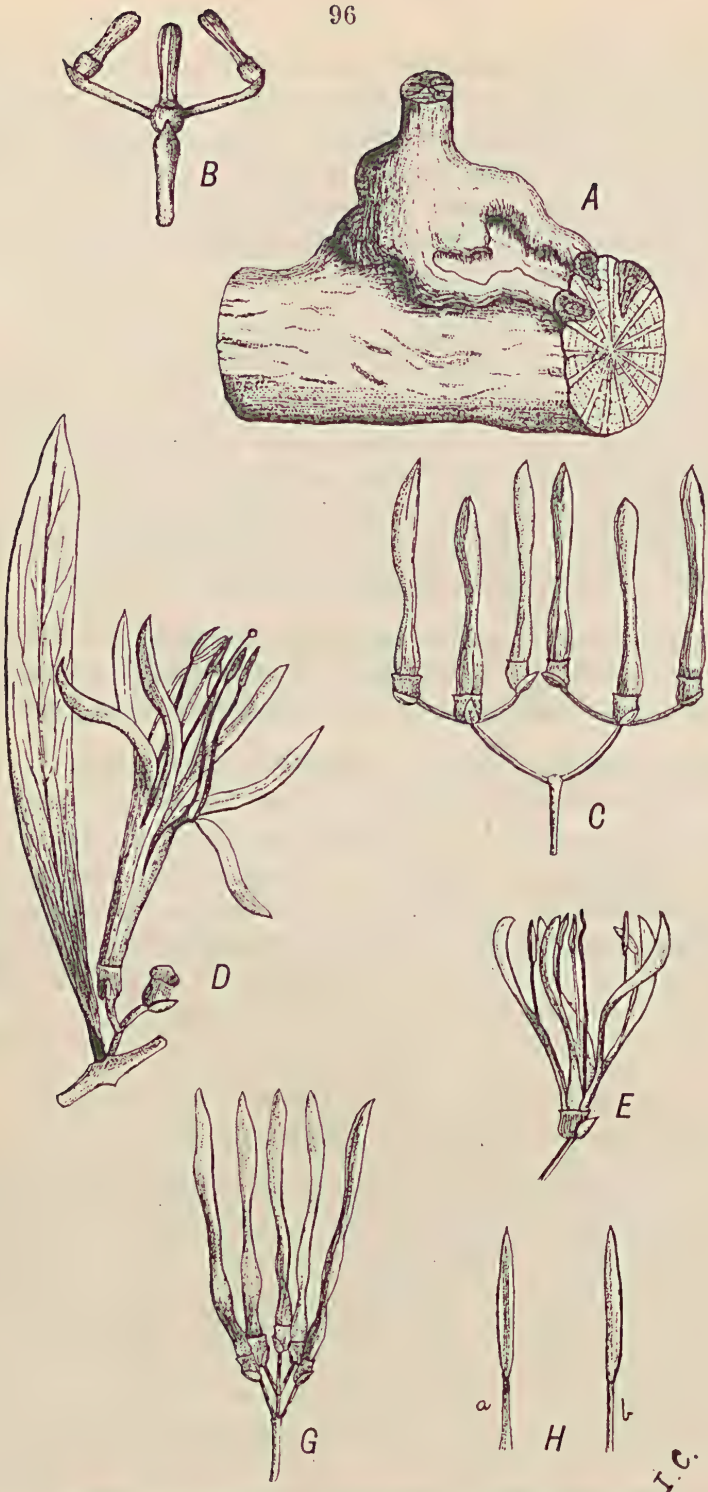


Plate XXXVIII.—*Loranthus*. The Misletoe.

A. *Loranthus europaeus* on an oak branch. All bark has been removed.
B. *L. filifolius*, three-flowered inflorescence.
C. *L. linophyllus*, inflorescence.
D. *L. exocarpi*, flower.
E. Flower.
G. *L. oleaefolium*, inflorescence.
H. Stamens (*a* and *b*).

(2) Leaves terete. *L. linophyllus.*
Leaves flat .. .. (3)

(3) Flowers in threes closely sessile. *L. Quandong.*
Flowers in threes (rarely in fives), all stalked or only the two lateral ones .. .. (4)

(4) Flowers an inch or more long. *L. pendulus.*
Flowers less than an inch long. *L. miraculosus.*

(5) Flowers several in racemes. *L. longiflorus.*
Flowers solitary or in pairs. *L. exocarpi.*

Loranthus celastroides, Sieber. " Common Mistletoe."

Very widely spread in Victoria mainly on *Myrtaceae*, but also on a variety of other hosts. Also in Australia generally.

Loranthus longiflorus, Desr. " Long-flowered Mistletoe."

Widely spread in Victoria and Australia, mainly on *Myrtaceae*. Also in Ceylon, the Moluccas and Himalayas.

Loranthus linophyllus, Fenzl. " Slender Mistletoe."

Widely spread in Victoria and Australia, mainly spread on *Myrtaceae* and *Casuarineae*.

Loranthus exocarpi, Behr. " Harlequin Mistletoe."

Of rather localized distribution in Victoria. Not uncommon in the Mallee. Also in South Australia, New South Wales, Queensland and North Australia.

Loranthus Quandong, Lindl. " Grey Mistletoe."

Widely spread in Victoria and Australia.

Loranthus miraculosus, Miq. " Small-leaf Mistletoe."

Of localized distribution in Victoria. Extends also to South and West Australia.

Loranthus pendulus, Sieber. " Hanging Mistletoe."

Widely distributed in Victoria ; also in all the States of the Commonwealth except Tasmania.

SANTALACEAE.

An order of trees, shrubs or herbs many of which are more or less parasitic on the roots or more rarely on the stems of other plants. The leaves are always entire and sometimes reduced to decidous scales. The flowers are usually small, hermaphrodite, or unisexual by abortion, and then either polygamous, monoecious or dioecious. Perianth simple green or petaloid, more or less tubular at the base, often fleshy, four or

Plate XXXIX.—*Exocarpus cupressiformis.* The Cherry Ballart.

A. Branch showing dense foliage and developing fruits.
B. Branch showing flowers (natural size).
C. Flowers (enlarged.)
D. Branchlet showing developing fruits.
E. Longitudinal section of ripe fruit and basal aril.

five partite (rarely three or six). Stamens equal in number to perianth segments, usually attached to their bases and of equal or less length. Disc epigynous or perigynous. Ovary unilocular, more or less inferior. Style terminal, sometimes very short. Ovules one to three, rarely more, arising from the apex of a basal central placenta. Fruit an indehiscent one-seeded nut or drupe. Seeds without an integument and with abundant endosperm. A small order of 26 genera and 250 species, widely spread in tropical and temperate regions, but mainly in dry districts. About 45 species occur in Australia of which three species of Santalum and ten of Exocarpus are endemic, while the five species of Fusanus are confined to Australia and New Zealand. The order is closely related to the *Loranthaceae* and shows certain connexions with the *Gnetaceae* among the *Gymnosperms*. The wood of *Santalum*, *Fusanus* and *Exocarpus* is used for furniture and cabinet work. The drupes are often edible, as are the fleshy fruit stalks of the Native Cherry (*Exocarpus*) and the oily seeds in some cases.

Ovary superior	..	*Exocarpus.*
Ovary inferior	.	*Fusanus.*

EXOCARPUS.

A genus of some seventeen species of which twelve are Australian. Trees or shrubs with alternate, occasionally opposite leaves, often falling readily, or reduced to scales. Flowers small, sessile or shortly stalked, in small clusters in the axils of the leaves. Flowers hermaphrodite or unisexual by abortion. Perianth with four to five segments slightly concave at the tips. Stamens with short, broad filaments inserted at the base of the perianth segments and splitting longitudinally. Disc thick, four or five lobed, and enclosing the base of the ovary. Stigma sessile small, two lobed. Fruit a drupe or nut on a thickened fleshy stalk. Seed endospermic with a small terminal embryo and short cotyledons. In addition to Australia and New Zealand, the genus is represented in Malaysia, the Norfolk Islands, Madagascar and India. A decoction of *E. phyllanthoides* is used medicinally for sores and abscesses. Many of the fruits are edible. Two Victorian species have timber of some value. The seeds are short-lived, rarely germinating well after the first year.

Exocarpus cupressiformis, Lab. "Cherry Ballart." (Plate XXXIX.)

Description.—A small tree rarely exceeding 25 feet, often less, with a graceful habit and dense, dark green branches, sometimes looser and slightly drooping. Branchlets slender, terete, furrowed with the leaves reduced to small alternate scales. Flowers sessile, very small in shortly stalked spikes. Perianth segments five. Stigma sessile, and bilobed. In a few flowers only, the ovary develops to a small globular ovoid fruit which is raised on an enlarged succulent red pedicel.

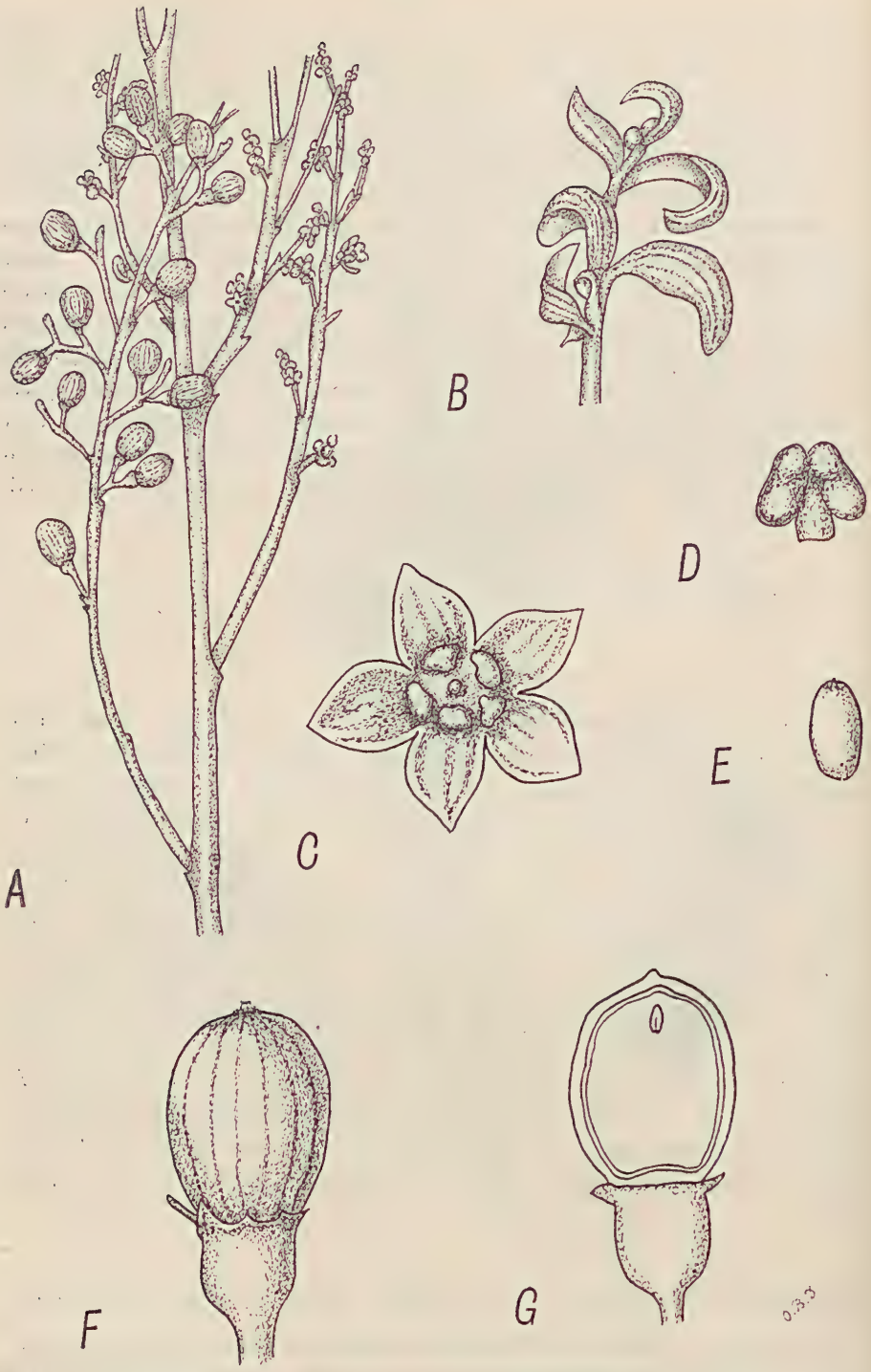


Plate XL.—*Exocarpus spartea.* The Broom Ballart.

A. Shoot with flowers and fruit.
B. An exceptionally broad-leaved branchlet.
C. Flower seen from above.
D. Stamen.
E. Pollen grain.
F. Fruit.
G. Fruit in vertical section, showing small embryo and large endosperm.

Habitat.—Widely spread in Victoria, usually in the neighbourhood of other trees on which its roots are parasitic. Also in all the States of Australia.

Timber.—Usually small, but hard and tough, close grained, reddish brown, with a small silver grain, and useful for turnery, furniture, cabinet work, carving, sticks and golf clubs. A cubic foot averages 50 lb. to 54 lb. when seasoned.

Owing to its parasitic habit the tree is difficult to transplant and is usually found growing singly or sparsely scattered near groups of other trees. Its growth is usually rather slow and it is easily destroyed by bush fires.

Exocarpus spartea, R.Br. "Broom Ballart." (Plate XL.)

Description.—Usually little more than a shrub, but sometimes a small tree of 15 feet to 20 feet height, resembling the native cherry, but with the branches more angular and less furrowed. Leaves linear subulate, one to two lines long, rarely thicker, broader and longer, sometimes deciduous, always more than one in the same axil. Perianth usually four partite and stamens four. Fruit as in the Native Cherry, the thick succulent pedicel shorter than the actual fruit.

Habitat.—A native of North-Western Victoria; also found in South Australia, Western Australia, Queensland and New South Wales.

Timber.—Usually too small to be of economic value, but when of sufficient size, equal to the best Native Cherry wood and useful for similar purposes. Another Victorian species is *Exocarpus stricta*, but it is rarely more than a shrub and is easily recognized by its lilac coloured aril.

FUSANUS.

A genus of four Australian and one New Zealand species of trees or shrubs with opposite or alternate leaves. Flowers hermaphrodite or female by abortion of the stamens. Perianth four to five partite, more or less united at the base, the segments free to the disc and with a tuft of hairs behind the stamens, which are shorter than the segments and united to them at the base. Ovary inferior, style short, stigma two or three lobed. Ovules two or three. Fruit a globular or oval drupe with a single globular seed and a central embryo in the endosperm.

Fusanus acuminatus, R.Br. "Quandong." (Plate XLI.)

Description.—Usually a tree of 20 feet to 30 feet but occasionally merely a tall shrub. Leaves shortly stalked, somewhat thick and leathery, opposite, lanceolate, pointed, 2 inches to 3 inches long, but rather variable.

Inflorescence a terminal panicle usually of many flowers. Lobes of the four partite perianth spreading but more or less concave. Disc prominent. Stamens four. Filaments curved and anthers short. Stigma, two or three lobed and almost sessile. Fruit globular, up to ¾ inch diameter with a fleshy mesocarp, and a pitted stony endocarp. Seed single, large.

Habitat.—A native of North-Western Victoria. Also in South Australia, Western Australia and New South Wales.

The tree is of fairly rapid growth but cannot be transplanted readily.

Fruits.—The fruits are edible, form a favorite food of emus, and the pulp can be made into jam or jelly. The seed is edible and nutritious and so oily that it burns like a candle nut. The aborigines used the pounded or macerated leaves for boils, sores and gonorrhoea.

Timber.—Pale brown, dense, tough, hard, heavy and close grained. Sap-wood pale or with a pinkish tinge. The wood works well and is excellent for furniture and cabinet work. A cubic foot of heart-wood averages 50 lb., and of the sap-wood 42 lb. The wood was used by the aborigines for producing fire by friction. It yields 5 per cent of an oil (C_{15} H_{24} O_2) very similar to Sandalwood oil and with similar medicinal properties.

A similar oil is obtained from the wood of *Fusanus persicarius*, F. Muell., which is a native of North-Western Victoria as well as of South and Western Australia. It is, however, usually too small to yield timber of economic value, although occasionally attaining the dimensions of a small tree. The two species can be distinguished as follows :—

F. acuminatus.—Panicle terminal. Fruit succulent, the perianth persisting until it is ripe.

F. persicarius.—Panicle axillary. Fruit hardly succulent, the perianth falling immediately after fertilization.

The closely-allied genus *Santalum* has a scale inside the corolla between each pair of stamens, and the flowers are larger. It is represented in Victoria only by *S. obtusifolium*, the blunt-leaved Quandong. This is a slender shrub and of no timber value owing to its small size.

RUTACEAE.

An order of shrubs and trees, rarely herbs, with usually alternate leaves and beset more or less with internal oil glands. Flowers usually rather small and hermaphrodite and two to five partite. Sepals free or united, often forming a cup-shaped calyx. Petals free, rarely united. A disc is present inside the bases of the stamens and the ovary is sometimes carried up on a gynophore. Stamens usually double the petals,

Plate XLI.—*Fusanus acuminatus*. THE QUANDONG.

A. Inflorescence.

B. Fruit showing hard pitted stone (*a*) and fleshy outer layer (*b*).

C. Side view of flower.

D. Flower seen from above, showing disk, stamens and short central style.

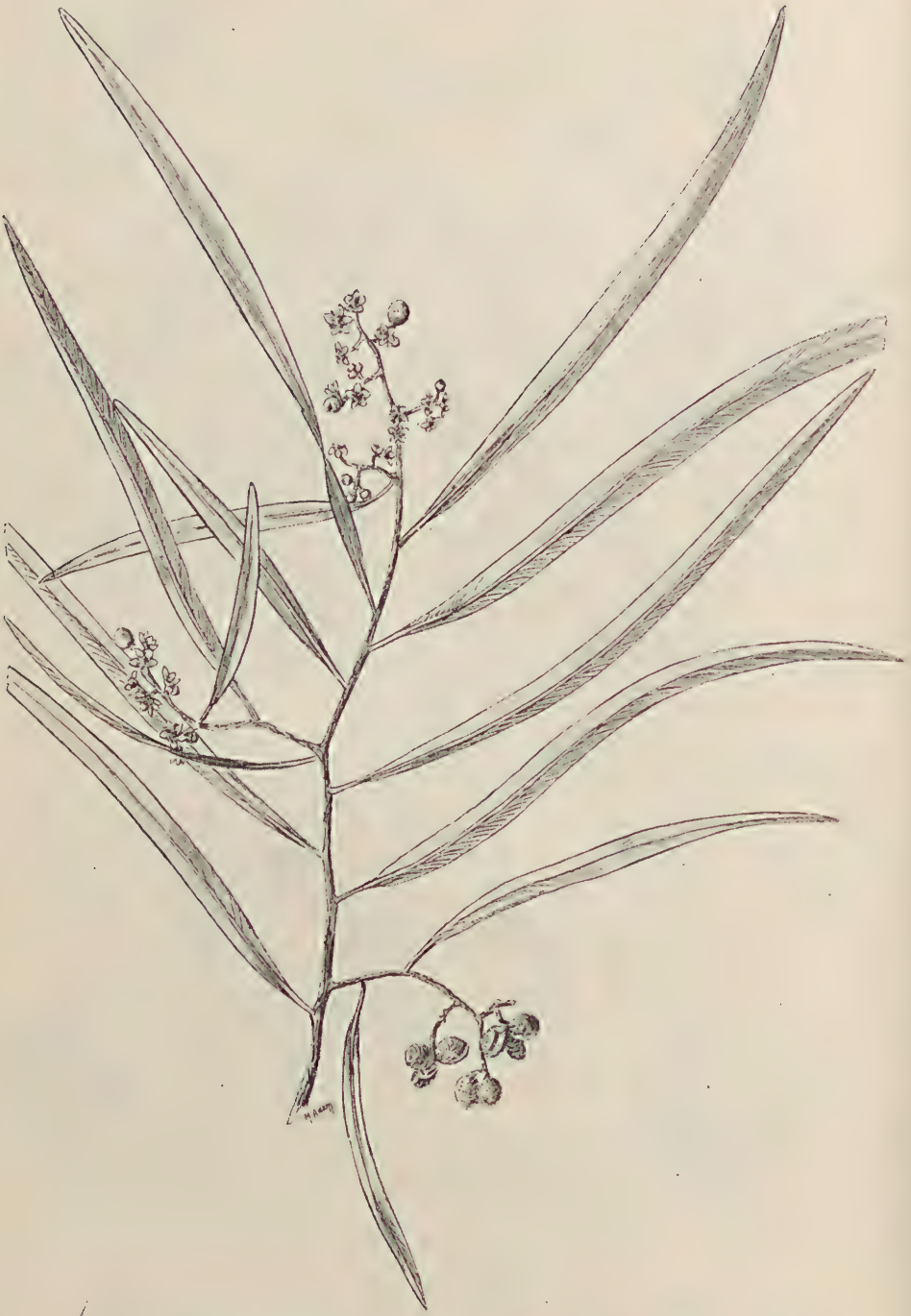


Plate XLII.—*Geijera parviflora.* The Wilga.
Leafy shoot with flowers and ripe fruits.

or less often as many, or three or four times as many. Carpels four to five, rarely three to one, either free at the base or united to form a chambered ovary with two or one seed to each chamber, or one-chambered with parietal placentation and numerous ovules. Style often basal or lateral, less often terminal. Fruit usually splitting into leathery or drupaceous cocci, rarely a capsule, drupe or berry. A widely spread order, mainly in the tropics and sub-tropical regions; not extending to the extreme north or south of the globe, well represented in Australia. Only six species in Victoria approach tree-like dimensions. It contains 112 genera and about 1,000 species, including many edible fruits, oranges, lemons, citrons, many medicinal or aromatic shrubs and scented flowers, and but few useful timber trees.

GEIJERA.

Sepals and petals four to five, the latter with inflexed tips. Stamens four to five free. Carpels four to five completely united, each with two ovules. Ovary four or five lobed sunk in the disc. Style short, stigma capitate, four to five lobed. Cocci one to three, two-valved, one-seeded. Seed round, hard, shining. The genus is wholly Australian and includes five species, extending from Queensland to Victoria and Western Australia.

Geijera parviflora, Lindl. "Wilga." (Plate XLII.)

Description.—A tall shrub or small tree attaining a height of 20 feet to 30 feet, with ovate lanceolate leaves, obtuse or pointed, and mostly three to four lines long, with a relatively long petiole. The numerous small white flowers are grouped in rather loose, broadly pyramidal panicles. The petals are about a line long and enclose four or five stamens. The fruit consists of separating one-seeded pieces, sometimes only one or two to each flower. The pieces or cocci are obovoid and two to three lines long, with a persistent or partially separating endocarp.

Habitat.—A native of North-Western Victoria; also in New South Wales, Queensland, South and Western Australia.

Timber.—Too small to be of economic value, except for furniture and cabinet work.

ZIERIA.

A small genus of ten species of shrubs or small trees, usually with opposite leaves and small white flowers, confined to Eastern Australia. Flowers four partite. Sepals united at the base, petals free. Disc of four glandular lobes, a stamen arising on the outer edge of each lobe. Carpels more or less united, with two ovules in each. Styles nearly terminal, united at least at the tip. Stigma four lobed. Fruitlets splitting by two valves, usually one-seeded.

PLATE XLIII.—*Zieria Smithii.* The Sandfly Zieria.

A. Leafy flowering shoot.
B. Vertical section of flower.
C. Fruiting branch.
D. Seed.

Zieria Smithii, Andrews. "Sandfly Zieria." (Plate XLIII.)

Description.—A tall shrub or small tree 10 feet to 20 feet high, with the leaves divided into three leaflets on a common stalk. The leaflets are lanceolate, or sometimes oblong, acute or rarely obtuse, and 1 inch to 2 inches long. The white flowers are usually about three lines in diameter, and are grouped in loose cymes with small bracts. The calyx lobes are broad and short and the petals are three times as long and hairy outside. The four stamens have obtuse anthers. The fruit consists of cocci about two lines long, with a glabrous or usually glandular tuberculate surface. The seeds are shining and finely reticulate or striate.

Habitat.—Native to South-West, South, North-East, and North of Victoria, extending from the Grampians and Otway Ranges eastward along humid forest valleys and ascending to elevated mountain ravines; also in New South Wales, Queensland, and Tasmania.

The plant is often grown as a garden shrub, as is also the larger tree-like variety, *macrophylla*.

Timber.—Too small to be of economic value except for cabinet work.

BORONIA.

A genus of about 60 species of shrubs, rarely herbs or small trees, found mostly in Western Australia, with simple or pinnate leaves and axillary or terminal four partite flowers. Sepals united at the base. Petals free. Stamens eight, four often infertile. Filaments usually broad and hairy, narrowed below the anthers. Carpels united at least by the styles, each with two ovules. Stigma entire or four lobed. Four two-valved fruitlets each with one or two seeds. The seeds are short-lived, rarely germinating well after the first year.

Many species are cultivated in gardens for their coloured or scented flowers.

Boronia pinnata, Sm. "Pinnate Boronia." (Plate XLIV.)

Description.—Usually a shrub 10 feet to 12 feet, but attaining in rich, moist mountain soils (Baw Baws, &c.) a height of 35 feet to 40 feet and a diameter of over a foot. Leaves glabrous, compound with paired rather distinct linear to elliptic lanceolate leaflets. Flowers conspicuous. One to three or more together in stalked cymose clusters. Petals pink. Stamens with hairy filaments. Seeds shining, smooth.

Habitat.—A native of South-West, South, North-East, and East Victoria; also in New South Wales, Queensland, South Australia, and Tasmania.

Plate XLIV.—*Boronia pinnata.* The Pinnate Boronia.

A. Flowering shoot.
B. Gynaeceum, after removal of stamens and perianth.
C. The same with the stamens.
D. Gynaeceum in vertical section showing ovules.

squameum

Plate XLV.—*Phebalium ~~Billardieri.~~* The Satinwood.

A. Branch with leaves, buds, and flowers.
B. Enlarged flower.
C. Vertical section of ovary, showing ovules and placentation.

Oil.—The flowers are perfumed. Flowering shoots yield 0·3 to 0·4 per cent of oil on distillation. It contains about 70 per cent. elemicin, a tri-methoxyphenol ether, only known previously from oleo-resin of Canarium commune (Burseraceae). In addition, geraniol, geranylacetate, phenol, and pinene are present. According to Welch and Penfold, the oil consists mainly of terpenes and sesquiterpene. (R.S., N.S.W., 1922, 200.) From an allied form, B. thujone, a ketone known as "thujone" has been extracted. It has an aroma like the black currant.

Timber.—Usually too small to be of economic value, but when larger useful for cabinet work and furniture.

PHEBALIUM.

An Australian genus of about 35 species, mainly in Eastern Australia, with alternate leaves often prominently glandular, and small white or yellow flowers. Sepals usually five, more or less, united at the base. Petals five, concave or bent in at the tip. Stamens ten, rarely eight or twelve. Carpels five, forming two valved usually one-seeded cocci. The seeds are short-lived, rarely germinating well after the second year.

Phebalium Billardieri, A. Juss. "Satinwood." (Plate XLV.)

Description.—An erect shrub or small tree 20 feet to 40 feet high with oblong, lanceolate or linear leaves, rarely under half an inch long and often 3 inches in length. The flowers are grouped in axillary corymbs, on thick and scaly stalks shorter than the leaf-stalks. The calyx is small and lobed and the petals are about two lines long, with the (usually) ten stamens projecting beyond them, on filaments often hairy near the base. The ovary is glabrous and separates into small broad cocci, each with a short beak. The seeds have a shining surface.

Habitat.—A native of the South of Victoria, in damp forest valleys near Apollo Bay, towards Cape Otway, and near the sources of the Barwon River; also in New South Wales, Queensland, and Tasmania.

Timber.—Pale, hard, dense, somewhat resembling that of English Box, (*Buxus sempervirens*), and useful for carving, turnery, veneers, and cabinet work. A cubic foot averages 50 lb. when seasoned.

CORREA.

A genus of six species of shrubs or small trees in Southern and Eastern Australia. Leaves opposite, stalked. Flowers rather large, white, green, yellow, or red. Calyx tube short, entire or with four teeth or lobes. Petals four, united to form a tubular corolla, more or less free at the tip. Disc short, eight lobed. Stamens eight on long stalks. Carpels free at the base, the styles united to a single thread, each with a pair of ovules. Fruit splitting into four two-valved cocci, each usually with one seed. The seeds rarely germinate when more than a year old.

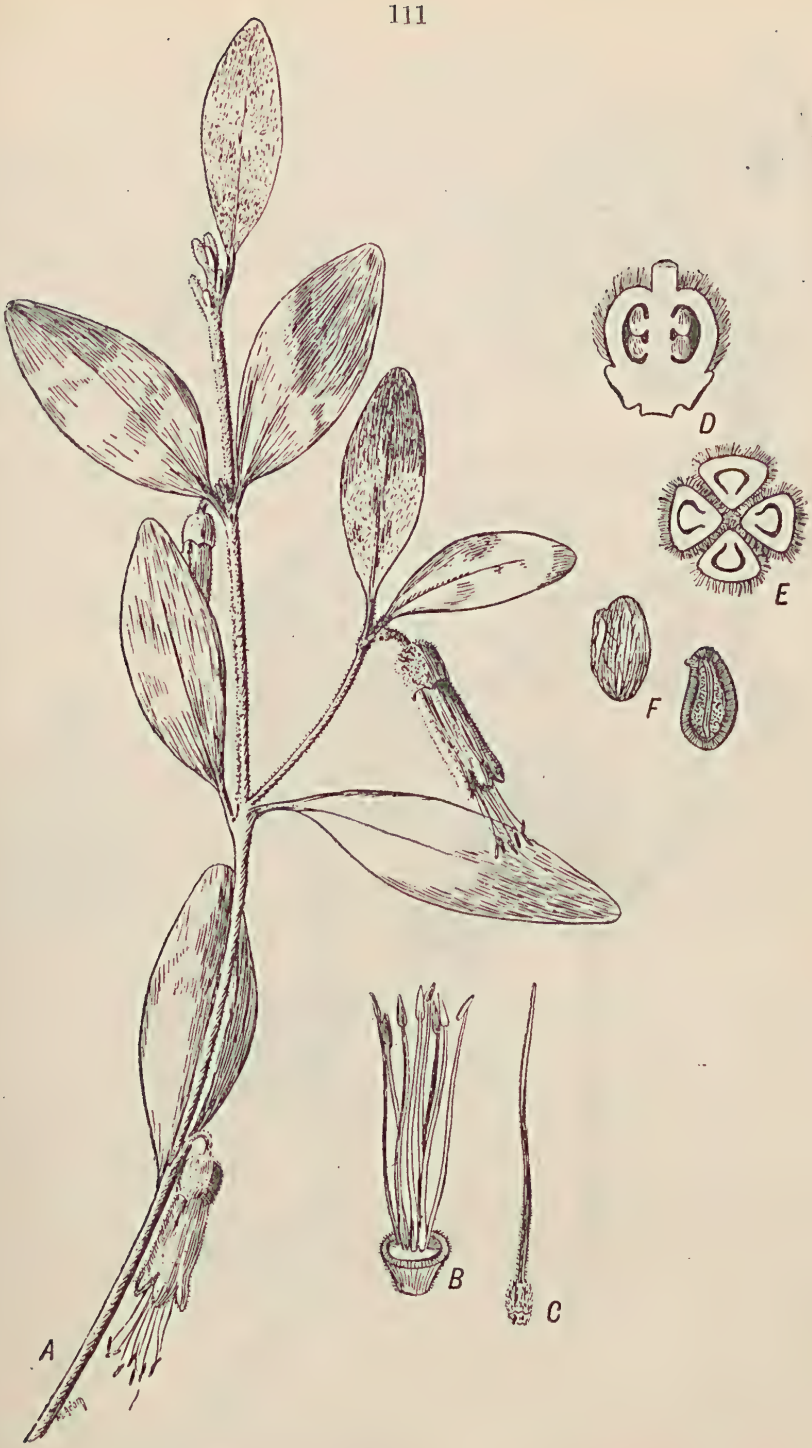


Plate XLVI.—*Correa Lawrenciana.* The Mountain Correa.

A. Twig with flowers.
B. Androecium. C. Gynaeceum.
D. Section of ovary with seeds (vertical).
E. Section of ovary (horizontal) showing one-seeded cocci.
F. Coccus entire and in vertical section, showing rod-like embryo and endosperm.

} *Correa speciosa.* (B.–F.)

Plate XLVII.—*Acronychia laevis*. The Yellow-wood.

A. Branch with fruits.
B. Branch with flowers.
C. Thalamus, calyx, and gynaeceum.
D. Vertical section of same.

Correa Lawrenciana, H.K. "Mountain Correa." (Plate XLVI.)

Description.—A shrub usually tall or rather slender but attaining a height of 15 feet to 20 feet, with stalked, ovate to oblong, sometimes obtuse, leaves, usually ½ inch to 1 inch long, but sometimes 2 inches or over 2 inches long. The flowers are axillary or terminal in groups of one to three on short hanging stalks. The calyx is hairy and truncate with four small teeth. The petals are hairy outside, united for the greater part of their length into a cylindrical corolla ¾ inch to 1 inch long, with eight projecting stamens. Ovary with four loculi, each with two ovules. Fruit splitting into four one-seeded cocci.

Habitat.—A native of the South, North-East, and East of Victoria, in sub-alpine localities, descending along rivulets and torrents to an elevation of 1,000 feet; also in New South Wales, and Tasmania.

Timber.—Too small to be of economic value.

ACRONYCHIA.

A genus of about twenty shrubs and trees, with alternate leaves and small flowers, confined to Australia and tropical Asia. Sepals four, united to the middle. Petals four, valvate, later spreading or reflexed. Stamens eight, the four opposite the petals often small or absent. Carpels united to a four-chambered ovary, each loculus with two ovules, and one or two seeds when ripe. Fruit dry or drupaceous.

Acronychia laevis, R. and G. Forster. "Yellow-wood." (Plate XLVII.)

Description.—A tree attaining a height of 70 feet to 80 feet with irregularly opposite or alternate, ovate, obtuse leaves, 1½ inches to 3 or 4 inches long. Flowers few in cymes. The sepals are very short, rounded and glabrous. The petals are narrow with inflexed tips, 2 to 2½ lines long. The eight stamens have rather thick filaments, swollen and ciliate at the base, slender and inflexed at the top. The ovary is hairy around the base of the style, which is rather long, and is topped by a slightly four-lobed stigma. The fruit has a four-celled endocarp.

Habitat.—A native of Eastern Victoria and Gippsland. Also in New South Wales and Queensland.

Timber.—Yellow, hard, straight-grained, dense and compact. A cubic foot weighs about 54 lb. Useful where hardness and strength are required, as for machine bearings. Also for carving, turnery, brushes, as well as for veneers and cabinet work.

Plate XLVIII.—*Codonocarpus cotinifolius.* The Bell Fruit.

A. Branch with fruits.

B. Branch with flowers.

PHYTOLACCACEAE.

A small order of herbs, shrubs and trees, most abundant in Southern Africa and tropical and sub-tropical America, and comprising 24 genera and nearly 100 species, with entire leaves and inconspicuous flowers, hermaphrodite or unisexual by reduction. Perianth, four or five partite, usually regular. Stamens, four or five to many, often united at the base. Ovary superior of several carpels united or free, one style to each. Seeds single in each carpel or loculus. Fruit indehiscent, often sappy, or dry and capsular with loculicidal dehiscence. The seeds are short lived, rarely germinating well after the first year. The order is of little economic value. The fruits of *Phytolacca* yield a red dye (Red Ink Plant) and the roots are strongly purgative and emetic. For the most part this order consists of herbaceous or shrubby plants, only one Victorian member of the order attaining fairly large dimensions. Gyrostemonaceae

Codonocarpus cotinifolius, F.v.M. "The Bell Fruit." (Plate XLVIII.)

Description.—It is usually a tall shrub, but also grows to a smal tree 20 feet to 40 feet high. The greyish green-leaves vary from broad lanceolate to almost orbicular and are contracted into a long petiole 1 inch to 2 inches in length. The flowers are dioecious or monoecious but usually the two sexes are in separate racemes in the upper axils of the leaves, the males very short, the female racemes on long stalks. The male flowers have fifteen to twenty stamens. The ovary consists of 20 to 30 or more carpels and is about twice the length of the calyx. The fruit is obconical or obovate and about six lines long.

Habitat.—The plant is a native of North-Western Victoria, growing in Mallee scrub on the Murray, Huon, Wimmera and Dallachy Rivers. Also in Queensland, New South Wales, South, West and North Australia.

Timber.—Rarely of sufficient size to be of economic value. Owing to its deeply penetrating roots it grows and remains green in very dry areas.

The aborigines use its sappy roots as food.

MAGNOLIACEAE.

A small order of nine genera and about 60 species, many tropical trees with large and sometimes with very large flowers (*Magnolia*, *Liriodendron*) and alternate undivided or lobed leaves. Flowers hermaphrodite or unisexual, hypogynous, the parts spirally arranged. Stamens numerous. Carpels usually numerous, free, each with a single endosperm. Seed with a small embryo. Oil canals present in the parenchyma of the stem. Although Magnolias are commonly planted in gardens, shrubberies and aboretums, and the timber is of value in many species, only one native representative attains tree-like dimensions.

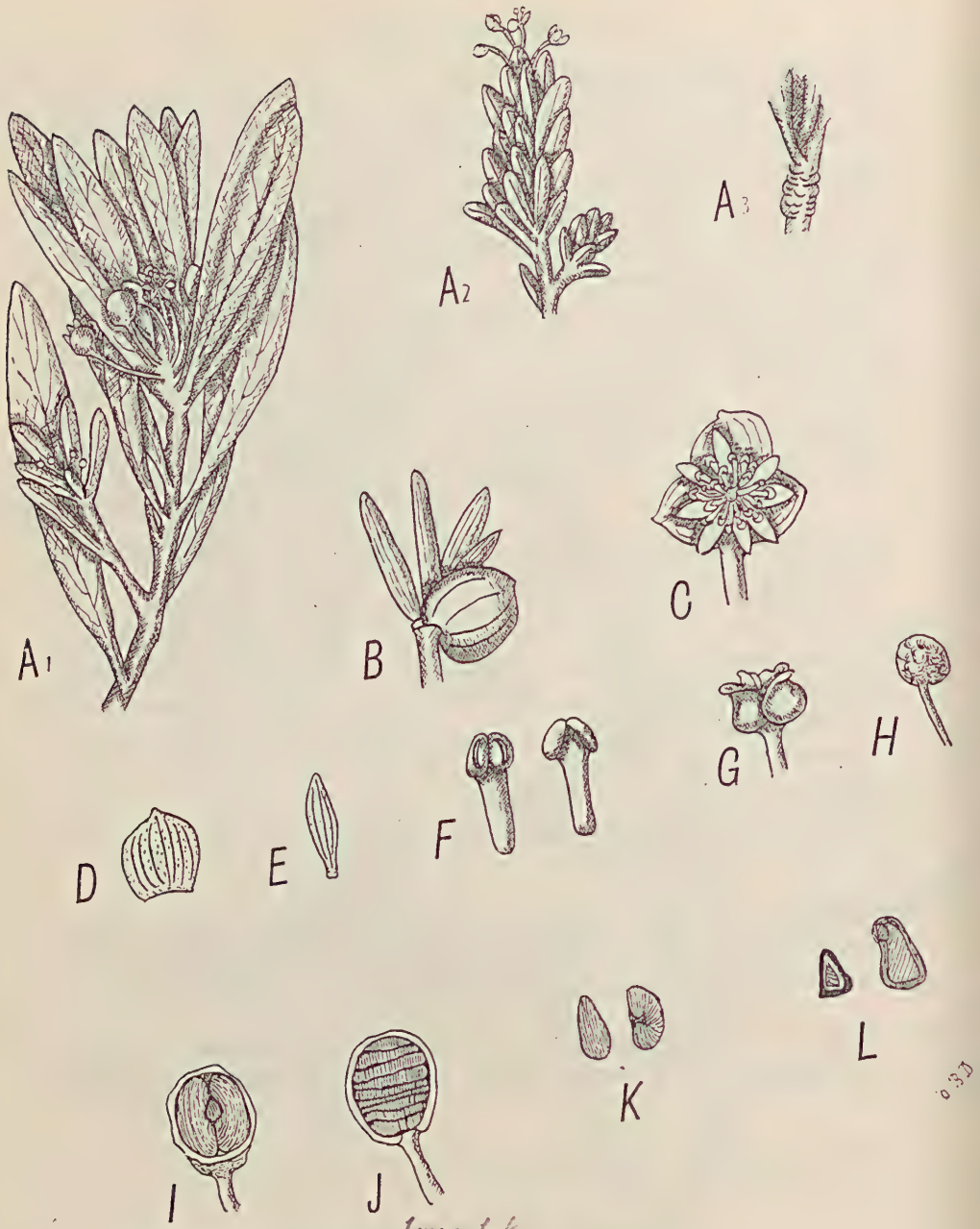


Plate XLIX.—*Drimys ~~aromatica~~ lanceolata*. The Mountain Pepper.

A 1, A 2, A 3. Branchlets with flowers.
B. Unexpanded flower with leaves.
C. Expanded flower.
D. Sepal.
E. Petal.
F. Front and back view of stamen.
G. Ovaries.
H. Fruitlet.
I. Transverse and J. Longitudinal section of fruitlet.
K. Seed.
L. Transverse and longitudinal section of seed.

DRIMYS. Winteraceæ

A genus of about ten species extending from South America to Australia, New Zealand, New Caledonia and Borneo. The bark of *D. Winteri* is used in popular medicine as a remedy for scurvy and other diseases. Flowers unisexual or hermaphrodite. Sepals two to four united. Petals two to eight or more. Carpels two, with sessile stigmas and numerous ovules. The seeds rarely germinate well after the first year.

D. lanceolata (Hook.) Baill.

Drimys aromatica, F.v.M. "Mountain Pepper." (Plate XLIX.)

Description.—It is a shrub or small tree 10 feet to 30 feet high with linear-lanceolate leaves. The flowers are polygamous (male, female and hermaphrodite), in terminal umbels. The two or rarely three sepals are united. The petals are free and vary from two to eight. The stamens are numerous. The ovary is superior and consists of one or rarely two to three distinct carpels. The fruit is a globular berry, the size of a pea.

Habitat.—The plant grows in the South, North-East and East of Victoria, on humid forest ranges from Mount Disappointment and the Dandenong Ranges to the Australian Alps, ascending to an elevation of at least 5,000 feet; also in New South Wales and Tasmania.

Timber.—Pale, rather soft, of moderate strength, but too small to be of much economic value. It is, however, of interest because of the absence of true vessels (pores). The regular arrangement of the tracheides with their small bordered pits gives it a striking resemblance to Conifer wood. The bordered pits are, however, smaller and more numerous and closely-set, and the medullary rays are broader in the vertical direction.

ANONACEAE.

Woody plants with entire exstipulate leaves and oil canals. Flowers usually hermaphrodite and hypogynous but perigynous in *Eupomatia*. Perianth segments usually three rings of three, except in *Eupomatia*, in which they are absent. Stamens numerous, spirally arranged. Carpels usually free and numerous. Fruit usually a berry, ovules anatropal. Seeds endospermic with a small embryo.

The order is mainly tropical and includes many medicinal plants and tropical edible fruits. (*Uvaria*, *Anona*, &c.) and many useful timber trees. It includes 46 genera and about 750 species. The order has a single forest representative in Victoria.

EUPOMATIA. Eupomatiaceæ.

Shrubs or small trees with terminal or axillary flowers covered at first by a large bract forming an operculum over the flower and breaking away when the flower opens. No perianth. Stamens numerous, broader

and petaloid towards the centre. Carpels many, closely compressed, and enclosed by the fleshy berry-like thalamus tube, which somewhat resembles a rose-hip.

Eupomatiaceae

Eupomatia laurina, R.Br. "Bolwarra." (Plate L.)

Description.—A tall shrub or small tree, attaining a height of 10 feet to 20 feet. The leaves are three to four, sometimes 5 inches long, with short stalks. The flowers are solitary on short lateral or axillary peduncles. The stamens are numerous and some are infertile, greenish-yellow, more or less united and shorter than the spreading fertile stamens. The fruit is $\frac{3}{4}$ inch in diameter and almost urn-shaped.

Habitat.—A native of the East of Victoria, fairly widely spread in Gippsland; also in New South Wales and Queensland.

Timber.—Too small and scarce to be of economic value, but can be used for turnery and small purposes.

MONIMIACEAE.

An almost exclusively tropical and sub-tropical order of shrubs and trees, usually with opposite, rarely alternate, leaves and aromatic oil glands. Flowers regular hermaphrodite or unisexual with numerous small perianth segments, the outer ones sometimes sepaloid and the inner ones petaloid. Stamens variable, either few in one or two rings or numerous. Carpels free, usually numerous in the fruit, often sunk in the enlarged axis, each with one seed. Seed endospermic with a small embryo. The order includes 23 genera and about 160 species of which two genera and species are represented in Victoria by tree-like forms.

HEDYCARYA.

A genus of some ten species of trees and shrubs with opposite, leathery, entire or toothed leaves, spread over Australia, New Zealand, New Caledonia and the Fiji Islands. Male flowers with small perianth segments, the stamens almost sessile all over the inner side of the thalamus cup. Female flowers with numerous carpels each with a short style. Fruit drupaceous.

Hedycarya angustifolia, Cunn. "Austral Mulbery." (*H. Cunninghami*, *Tulasne.*) (Plate LI.)

Description.—It is a tall shrub and finally a small tree, 10 feet to 20 feet high, with ovate, toothed, pointed, short-stalked leaves. The greenish flowers are male and female. The perianth is hemispherical or flat with about eight (seven to ten) small inflexed lobes. The stamens are numerous and closely-set on the inside of the perianth, sessile or

Plate L.—*Eupomatia laurina.* The Bolwarra.

A. Twig with flowers.
B. Twig with fruits.
C. Enlarged flower.
D. Section of seed.

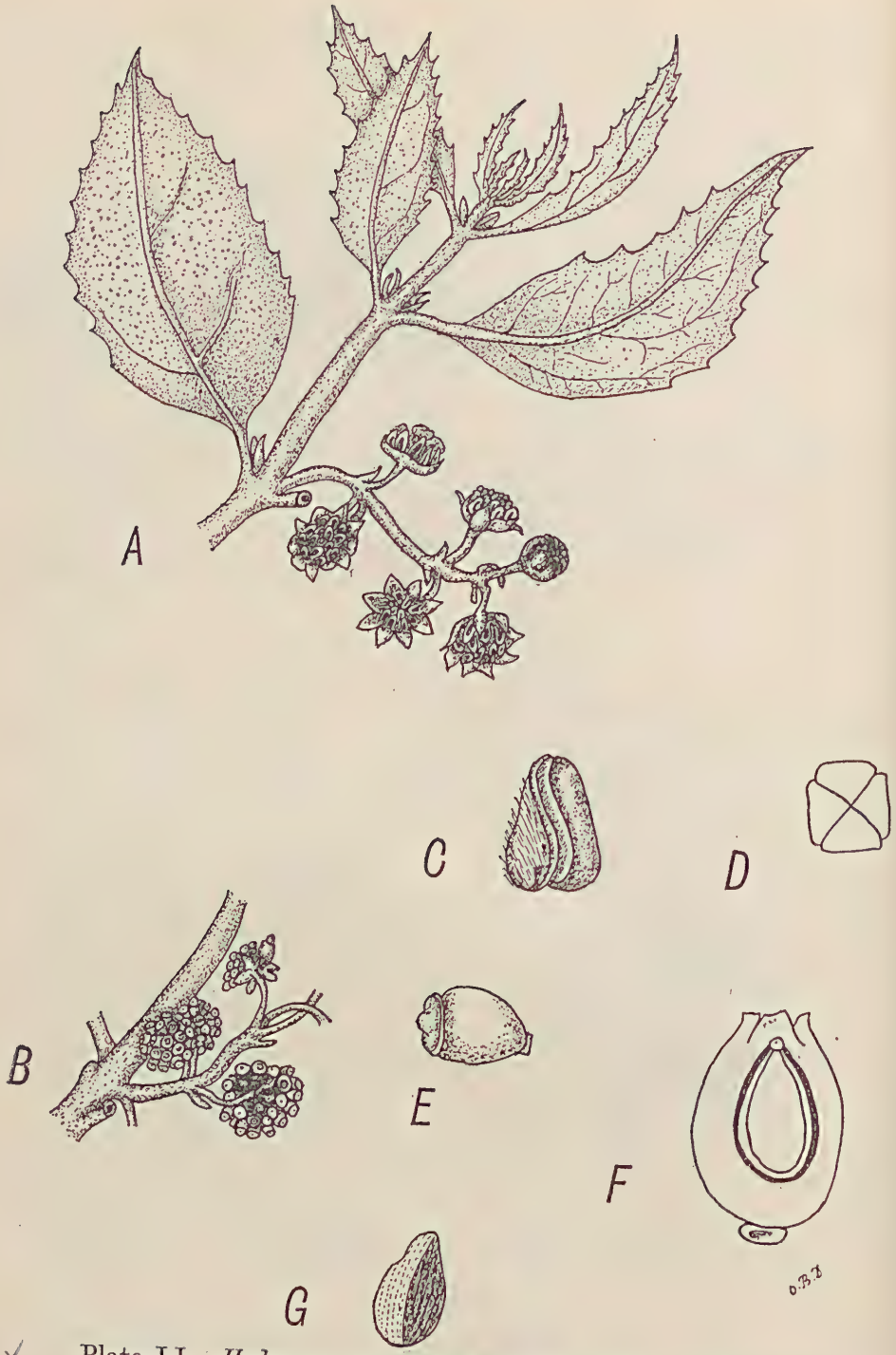


Plate LI.—*Hedycarya angustifolia.* The Austral Mulberry.

A. Flowering shoot.
B. Fruit.
C. Anther.
D. Pollen grain.
E. Fruitlet.
F. Longitudinal section of a fruitlet.
G. Seed.

Plate LII.—*Atherosperma moschatum.* The Southern Sassafras.

A. *Atherosperma moschatum.*

B. Male flower—
1. Involucre closed.
2. Involucre opening.
3. Bracts fallen, perianth opening.
4. Longitudinal section showing stamens.
5. Stamens (perianth removed).
6. Stamen (enlarged).

C. Female flower—
7. Involucre closed.
8. Involucre opening.
9. Bracts fallen, perianth opening.
10. Longitudinal section showing ovules.
11. Fruitlets in persistent thalamus cup, shown empty in (12).
13. Fruitlets with plumose pappus.

nearly so. The carpels are numerous (ten to twenty), and the fruits are drupaceous and nearly globular. The seeds rarely germinate well after the first year.

Habitat.—A native of South-Western, Southern, North-Eastern and Eastern Victoria, and in moist forest gullies of the fern-tree country, from Cape Otway to Mount Disappointment and through the Western-port district and Gippsland to Wilson's Promontory ; also in New South Wales and Queensland.

Timber.—Too small to be of much economic value.

ATHEROSPERMA.

The genus includes a single species only, confined to Victoria and Tasmania.

Atherosperma moschatum, Labill. "Southern Sassafras." (Plate LII.)

Description.—A tree attaining a height of 20 feet to 40 feet and 1 foot to 2 feet in diameter, with a thick short-grained aromatic bark. The leaves are 1½ inches to 3 inches long, opposite, entire or toothed, shining above, greyish-green beneath. The flowers are solitary or axillary on stalks ¼ inch to ½ inch long, with two bracts, four to five lines long. Flowers hermaphrodite or unisexual. The male flower has about twelve stamens and eight to ten perianth segments. Female flowers with numerous carpels (the inner ones with elongated styles), numerous staminodia and deciduous perianth lobes. The thalamus is cup-shaped and four to five lines in diameter.

Habitat.—A native of South, North-East, and East of Victoria ; rather rare in dense, swampy forest gullies towards Cape Otway, more frequent at the sources of the Yarra, in the Dandenong Ranges, and in the Southern parts of Gippsland ; also in New South Wales and Tasmania.

The bark is aromatic, and a kind of herb tonic or tea can be brewed from it.

Timber.—Pale, light. Useful for cabinet work and turnery. A cubic foot when seasoned weighs 41 lb. to 43 lb.

LAURACEAE.

An order of shrubs and trees with usually alternate and leathery leaves, widely spread over the whole globe up to 50 degrees N. and 43 degrees S. The order includes 40 genera, and about 900 species. Owing to the presence of aromatic oil, many species yield spices or condiments ; Cinnamomum (Cinnamon, Camphor), Laurus, Litsea, Sassafras, Crypto-

BOTANIC & DOMAIN GARDENS

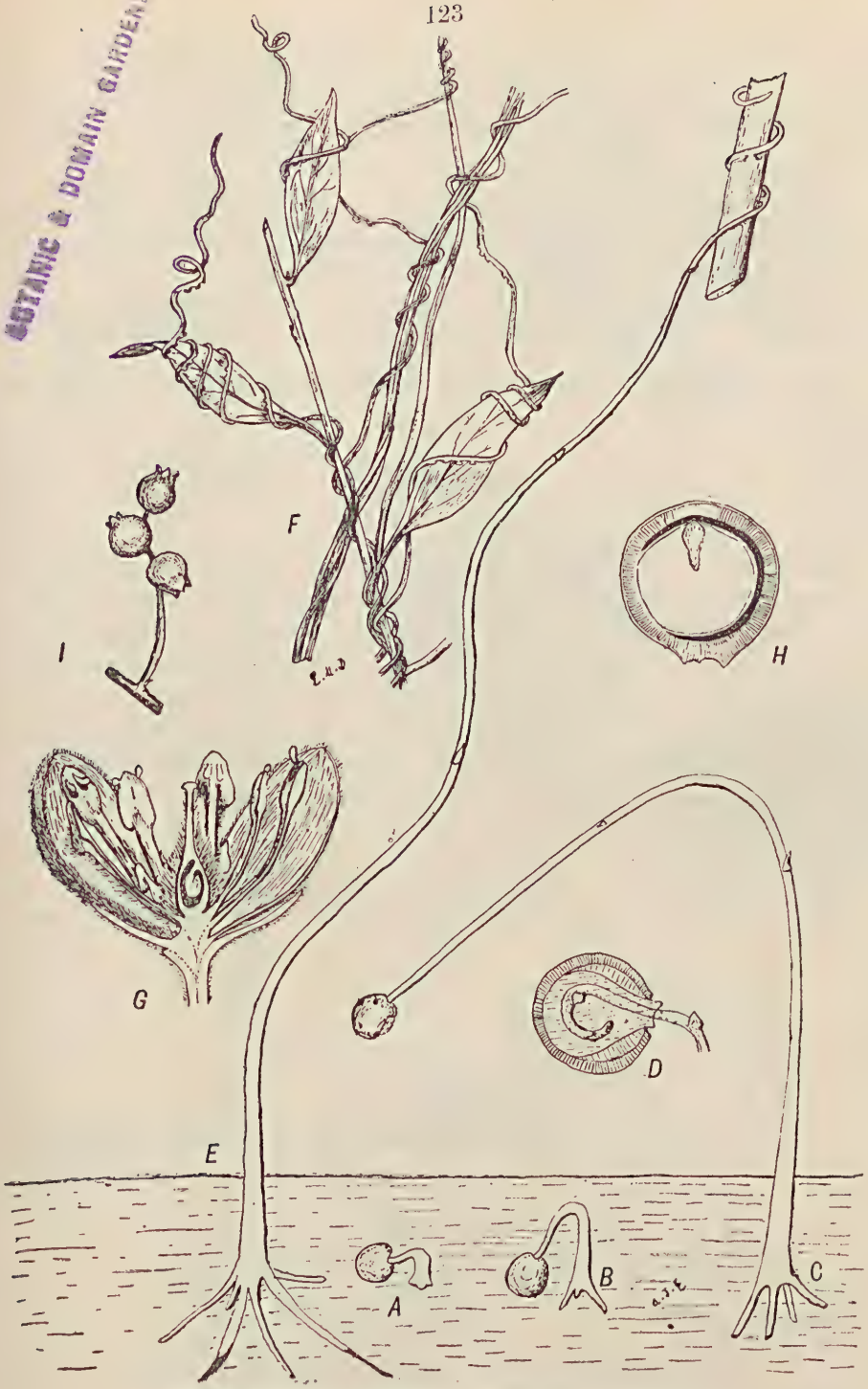


Plate LIII.—*Cassytha.* Dodder Laurel.

A. } Stages in germination of *C.*
B. } *melantha.*
C. }

D. Apex of stem about about to escape from seed.

E. Plant forming parasitic attachment.

F. *C. americana.*

G. L.S. flower *C. filiformis.*

H. L.S. fruit.

I. Fruits.

carya (American nutmeg); or are of value medicinally. Persea gives an important tropical fruit. The order is of less value for timber purposes, but camphor is obtained by distilling the wood of Cinnamomum Camphora.

Flowers regular, usually hermaphrodite and three-partite, with sepals and petals. Stamens perigynous or epigynous in three or four whorls or some reduced to staminodes. Ovary free, although more or less enclosed by the thalamus or fleshy bases of the perianth segments, one-chambered, one-seeded. Seed non-endospermic, cotyledons large, flat and fleshy.

The only native representative of importance is the parasitic "Bush Dodder," Cassytha.

CASSYTHA.

(Plate LIII.)

Description.—This is a twining plant attaching itself by suckers to its host and with the leaves reduced to small scales but the stem green and assimilating. Flowers small hermaphrodite, perianth tubular, three small outer, three larger inner segments. Stamens nine in three rings, and an inner ring of staminodia. Carpel free, one-seeded and in the fruit fused with the fleshy perianth. Seed endospermic, embryo small and rod-like, cotyledons absent. The seeds are rather hard though not cuticularized. They germinate best after filing and may remain germinable after three years in the soil.

Mostly parasitic on native shrubs, less commonly on tall trees or introduced plants. The seedlings are at first rooted, but the root soon shrivels.

Stems glabrous .. .. (1)

Stems more or less hairy .. .. (3)

(1) Fruit ellipsoid, red or yellow. *C. glabella.*
Fruit globular, green, drying black.. .. .. (2)

(2) Fruit large smooth, perianth with short dark lines. *C. melantha.*
Fruit with six raised ribs, perianth glabrous or nearly so. *C. paniculata.*

(3) Flowers distant, fruit pear shaped. *C. phaeolasia.*
Flowers crowded, fruit globular. *C. pubescens.*

Cassytha glabella, R. Br. "Tangled Dodder Laurel."

It is widely spread in all districts of Victoria and is found in all the other States of Australia.

Cassytha pubescens, R. Br. "Downy Dodder Laurel."

It is widely spread in all districts of Victoria and is found in all the States of Australia except the extreme North.

Cassytha phaeolasia, F. v. M. "Spiked Dodder Laurel."

Plate LIV.—*Capparis Mitchelli.* The Desert Caper.

A. Shoot with flower buds.
B. Flower.
C. Anther with a portion of the filament.
D. Flower stalk and ovary with its stipes.
E. Fruit.
F. Fruit cut transversely.
G. Longitudinal section of seeds.
H. Embryo.

Native of Portland, Port Phillip, River Yarra, East Gippsland; also in New South Wales.

Cassytha paniculata, R. Br. "Ribbed Dodder Laurel."

Native of East Gippsland, also in New South Wales and Queensland.

Cassytha melantha, R. Br. "Large Dodder Laurel."

Seed large, hard, round, dark, usually only germinating after being filed or softened by hot water.

Widely spread in all districts of Victoria, also in New South Wales, Tasmania, South Australia, and Western Australia.

CAPPARIDACEAE.

Usually herbs or shrubs, rarely small trees with alternate simple or palmate leaves. Flowers usually hermaphrodite and with a four-partite perianth. Sepals free or united. Petals usually free. Stamens four to numerous, sometimes raised on an androphore. Carpels two to many, united to form a one to several chambered ovary, more or less raised on a gynophore. Fruit a capsule, pod, berry or drupaceous. Seeds numerous, kidney-shaped, non-endospermic, the radicle often in a pocket of the seed coat. In many cases abnormal wood structure is shown, the stem developing new cambium rings forming successive rings of bundles, in which the whole or a portion of the phloem is enclosed along with the wood.

A small but widely spread order, almost wholly confined to the tropics and sub-tropics, often in dry and desert regions, only a few species extending to cool-temperate regions and alpine elevations. It includes 36 genera and about 400 species, but apart from the Caper Bush and a few medicinal plants, has little economic value and includes no important timber trees.

CAPPARIS.

A genus of 150 species of shrubs, climbers, or trees, widely spread in the warmer regions of both hemispheres but absent from north America. Petals free, stamens usually numerous, ovary of two to eight united carpels, usually on a long gynophore. Fruit one to several-chambered with numerous seeds. The seeds may last five or ten years. Seeds of *C. nobilis* showed a germination of 7 per cent. after ten years.

Capparis Mitchelli, Lindl. "Desert Caper." (Plate LIV.)

Description.—This is a small desert tree, attaining a maximum height of 20 feet to 30 feet. The flowers are solitary on rather long stalks. The leaves are ovate or oblong 1 inch to 1½ inches long and narrowed to a stalk of two or three lines. The buds are ovoid-globular and nearly

Plate LV.—*Bursaria spinosa.* The Sweet Bursaria.

A. Twig with flowers.
B. Fruits.
C. Flower from above.
D. Section of ovary showing seeds.
E. Vertical section of flower.

½ inch long. The outer calyx is thick, opening irregularly, or sometimes in two valvate sepals. The inner sepals are four to eight lines long. The petals are similar but larger, and enclose numerous stamens. The berry is globular and 2 inches in diameter when ripe, forming a hard, stony fruit in which the seeds are imbedded. The embryo is coiled or curved.

Habitat.—A native of North-West of Victoria, in Mallee Scrub ; also generally spread over the drier districts of Australia.

Timber.—Pale yellow, fairly hard, close in texture with narrow rings and a fine grain. A cubic foot weighs about 50 lb. when seasoned. It polishes well, and can be used for tool handles, furniture, veneers, frames, &c., but is usually of small size and rarely obtainable in any quantity.

PITTOSPORACEAE.

Trees or shrubs, often twining, with resin canals in the cortex of the stem, and alternate, often rather thick, leaves. Flowers white, blue, yellow, or red, hermaphrodite, usually regular and five partite with the exception of the gynaecium. Sepals and petals free or united at the base. Stamens free. Carpels two, rarely three to five, united into a one or several-chambered ovary. Fruit a loculicidal capsule or an indehiscent berry. Seeds numerous, endospermic with a small embryo, and often adhering in sticky masses.

With the exception of the genus Pittosporum, which extends to the Old World tropics and to South Africa, the order is confined to Australia. The resinous exudation has not been put to any economic use nor has much use been found for the timber of this order. It includes only ten genera and about 110 species, of which over 70 belong to Pittosporum.

BURSARIA.

A genus of one species with small white flowers, usually small entire leaves and often more or less thorny. Sepals small, free, deciduous. Petals narrow. Ovary incompletely two-chambered, forming a compressed capsular, purse-like fruit, with one or two seeds in each chamber.

Bursaria spinosa, Cavanilles. "Sweet Bursaria." (Plate LV.)

Description.—This is a shrub or small tree sometimes growing to a height of 20 feet to 40 feet and a diameter of 1 foot to 1½ feet. It extends from Queensland to Wilson's Promontory and is represented in different parts by various forms and varieties. It is one of the most polymorphic of Australian plants, varying chiefly in the shape and size of the leaves, in the presence or absence of spines and in the habit. It is easily recognized by the white, sweet-smelling flowers, and the abundant small brown, purse-like fruits.

Plate LVI.—*Pittosporum undulatum.* Sweet Pittosporum.

A. Shoot with fruits.
B. Shoot with flowers.
C. Flower in vertical section.
D. Flower from above.

The flowers are five-partite and are usually very numerous, in a broad pyramidal terminal panicle, on short stalks. The bracts are minute and soon fall off. The small sepals fall long before the petals open. The petals are narrow and about two lines long. There are five stamens and the single ovary forms a flat, bi-lobed capsule about three to four lines long.

Habitat.—A native of the North-West, South-West, South, North-East, and East of Victoria, common in all the lowlands as well as in mountain districts; also in New South Wales, Queensland, Tasmania, South Australia, and Western Australia.

Timber.—Pale, tough, hard, close-grained, works freely and seasons well. Suitable for tool handles, cabinet work, and small purposes. The tree is usually small and stunted, or bushy, but in rich, moist localities, is of fairly rapid and regular growth. A cubic foot averages 50 lb. when seasoned.

PITTOSPORUM.

The genus is easily recognized by its thick-walled, leathery, or woody capsules, splitting into two or three diverging valves to which the numerous sticky seeds adhere, whereas Bursaria has thin-walled capsules, with non-adhesive seeds. The seeds do not keep well when dried, being usually useless by the second year.

Pittosporum undulatum, Vent. "Sweet Pittosporum." (Plate LVI.)

Description.—A tree usually 20 feet to 30 feet high, but attaining a height of 60 feet to 80 feet under favorable conditions. Leaves stalked, lanceolate. Flowers white, sweet-scented, in compound clusters. The five sepals have pointed tips and are unequally united. The five petals are five to six lines long, and spreading from the middle. There are five stamens, and the almost sessile ovary forms a nearly globular capsule, rarely attaining ½ inch in diameter.

Habitat.—It is a native of the South, North-West, and East of Victoria, growing naturally on the banks of rivers in humid forest districts or rocky places about Western Port, Buchan, Tambo, Broadribb, and Snowy Rivers; also in New South Wales, Queensland and Tasmania. It is widely planted and is a favorite evergreen hedge plant. It does not thrive in dry, hot districts and does better on soils with some clay beneath than on deep sand or gravels, for which Coprosma or Tea Tree is more suitable. It should be cut twice yearly in hedges, at the close of winter and again in summer, to keep a close hedge. The young wood is soft and the cutting can be done rapidly with a sharp, curved hook, instead of with the tedious shears. The branches exude a sticky resin when cut. The resin can be removed from the hands by rubbing with fat or butter and then lathering with soap and a little water, gradually rinsing off the lather.

Plate LVII.—*Pittosporum revolutum.* The Curled Pittosporum.

A. Portion of a branchlet with flowers.
B. A fruit.
C. A flower.

Plate LVIII.—*Pittosporum bicolor.* The Banyalla.

A. Twig with flowers.
B. Flower.
C. Stamens and gynaeceum.
D. Gynaeceum in vertical section.
E. Branch with ripe and dehiscing fruits.

Timber.—Pale yellow, close-grained, tough, hard. Useful for carving, turnery, engraving, cabinet and inlay work, the heads of croquet mallets and golf clubs. A cubic foot weighs about 50 lb. when seasoned.

Pittosporum revolutum, Ait. "Curled Pittosporum." (Plate LVII.)

Description.—A tall shrub attaining a height of 10 feet to 20 feet. The leaves are more or less undulate, narrow, lanceolate to ovate, and 2 inches to 4 inches long. Flowers not numerous on a terminal, often decurved, stalk. The sepals are free and have pointed tips. The petals have five free lobes and are $\frac{1}{2}$ inch long. There are five stamens and a peltate stigma. The capsule is $\frac{1}{2}$ inch to $\frac{3}{4}$ inch long and is orange coloured and usually oblong. The seeds are numerous and red or brown.

Habitat.—A native of the East of Victoria and on ridges on the South-East boundary of Gippsland; also in New South Wales and Queensland.

Timber.—The wood is pale or yellowish and hard, and although usually too small to be of economic value can be used for turnery and small purposes.

Pittosporum bicolor, Hook. "Banyalla." (Plate LVIII.)

Description.—A small tree attaining a height of 20 feet to 30 feet and a diameter of 6 inches to a foot or so. The leaves are usually crowded, oblong, lanceolate, or almost linear, mostly 1 inch to 2 inches long, entire, nearly sessile or on very short stalks. The flowers are yellow and pink, clustered or solitary, the sepals oblong or lanceolate, the petals purple and yellow with five spreading lobes, and four to five lines long. There are five stamens and the ovary is villous. The fruit is a rounded, somewhat compressed, capsule four to five lines broad, hairy, with rather thin valves when open. The seeds are fairly numerous, usually 20 to to 30.

Habitat.—A native of the South, North-East, and East of Victoria, in tree-fern gullies from Wilson's Promontory to the Delatite River and Dandenong Ranges, and Mount Disappointment, also ranges towards Cape Otway and Apollo Bay, and at Mount Tambo, ascending to sub-alpine elevations; also in New South Wales and Tasmania, where it is sometimes known as Cheese Wood or White Wood.

Timber.—Pale or yellowish white. Usually too small to be of much use. A cubic foot when air-dry weighs 50 lb. The wood was used for clubs by the aborigines. It makes good axe handles, and can be used for carving and wood-engraving.

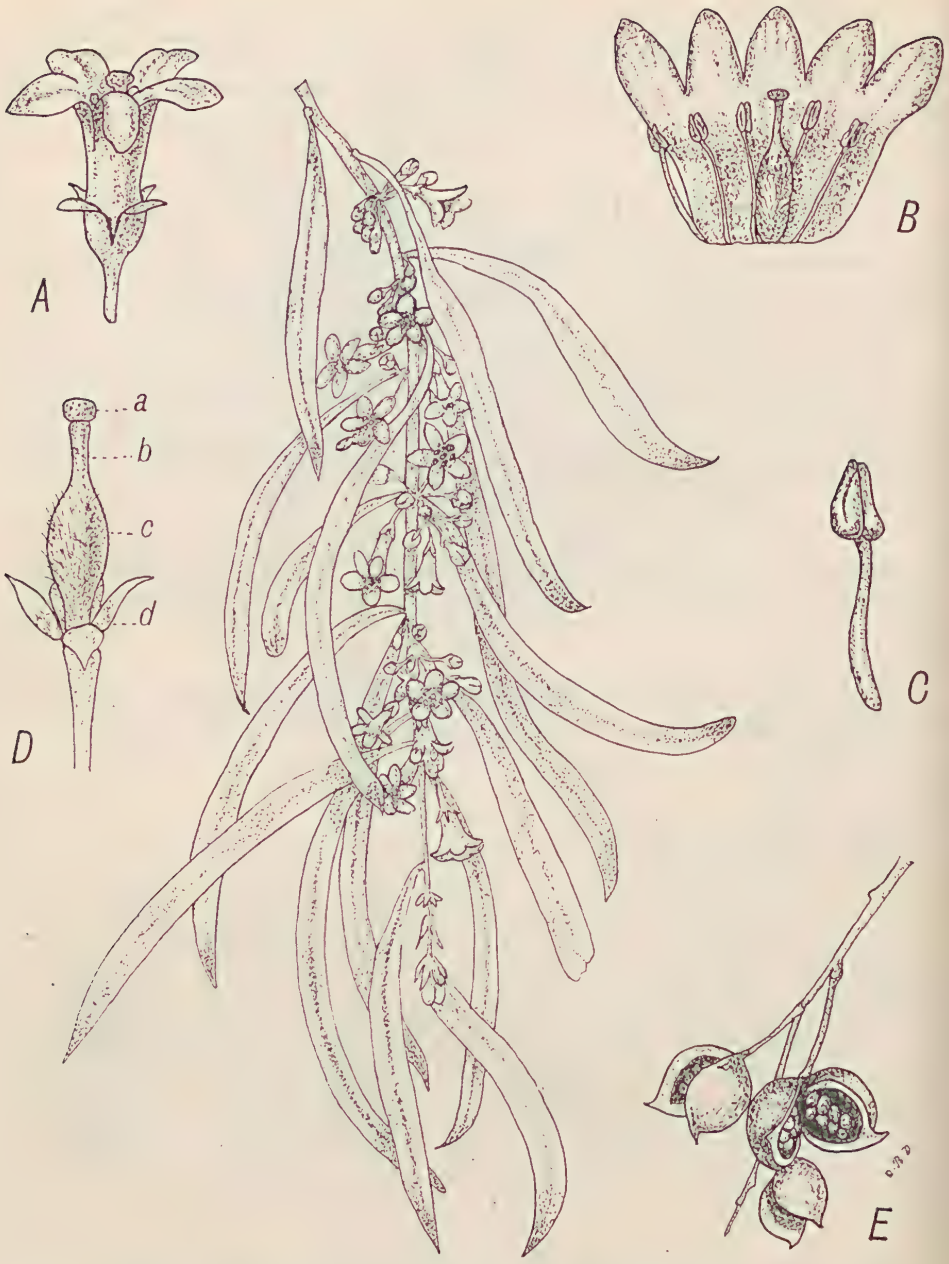


Plate LIX.—*Pittosporum phillyraeoides*. The Weeping Pittosporum.

A. A single flower.
B. The flower opened out, showing petals, stamens, and ovary.
C. A stamen.
D. Flower with corolla removed, showing—
   (*a*) Stigma.
   (*b*) Style
   (*c*) Ovary
   (*d*) Calyx.
E. Cluster of fruits, capsules, dehiscing, showing the seeds.

Pittosporum phillyraeoides, D.C. "Weeping Pittosporum."
(Plate LIX.)

Description.—A slender shrub or tree 10 feet to 30 feet high, with oblong or linear lanceolate leaves 2 inches to 4 inches long. The flowers are either solitary or in sessile or shortly-stalked axillary clusters or umbels, and are usually about four lines long, and sometimes of separate sexes, the female flowers then being fewer and larger than the males. The sepals are short and very obtuse and the petals three to four lines long, with five free lobes. There are five stamens. The capsule is much compressed, brownish-yellow and four to nine lines long, but usually about $\frac{1}{2}$ inch. Seeds few, sticky, dark red or orange.

Habitat.—A native of the North-West of Victoria on sandy barren or stony declivities or plains, dispersed through the arid zones; also in New South Wales, Queensland, South Australia, and Western Australia.

Timber.—The wood of the foregoing three species resembles that of *P. revolutum* and can be put to similar uses when obtainable in sufficient size and quantity. It is close-grained, pale, and very hard. Useful for turnery, cabinet work, and wood engraving, but too small to be of much commercial value.

The foliage is eaten readily by stock, and hence, when planted, it must be fenced off. It is grown readily from seed, which can be mixed with sand before planting to separate the sticky seeds. An infusion of the seeds, pulp, leaves, or wood taken internally relieves pain and cramp, and was formerly used medicinally by the aborigines. It contains saponin and is haemolytic. An excess is therefore injurious.

LEGUMINOSAE.

Of the three sub-orders of this large and widely-spread order, which all have in common a legume or lomentum-like fruit, the Caesalpineae are unrepresented by any large tree-like representatives, and the greater part of the Leguminous forest flora of Victoria belongs to the Mimoseae, including 32 species of Acacia, whereas the Papilionaceae have only a few shrubby or rarely tree-like native representatives.

MIMOSEAE.

Tree or shrubs, rarely herbs, with bi-pinnate or pinnate leaves sometimes reduced to phyllodes, usually small flowers, often in heads or spikes, the stamens usually projecting. Flowers radial. Calyx toothed or lobed, the sepals rarely free to the base, and usually five, rarely three, four, or six. Petals the same, free or partly united. Stamens as many, twice as many or numerous, free or united at the base. Pollen grains

often united in clusters or packets. Carpels usually one, sometimes none (male flowers of Acacia), rarely more than one. The sub-order is mainly tropical and sub-tropical and is well represented in Australia by very numerous species of Acacia, ranging from hygrophytes (Silver Wattle) to extreme xerophytes (various Mallee Acacias, Myall, &c.). It includes 30 genera and about 1,600 species, of which nearly one-half belong to Acacia, and one-fifth to Mimosa, which is unrepresented in Australia, except by the Sensitive Plant, *Mimosa pudica*, which is an introduced alien in tropical Australia.

ACACIA.

The genus of nearly 800 species is characterized by its numerous small hermaphrodite or polygamous flowers, clustered in heads or spikes, with a single stalked or sessile carpel, two to several seeds and numerous stamens, free or slightly united at the base. It consists wholly of shrubs and trees, the latter rarely of large size.

Although hardly more than ten of the Victorian Acacias regularly form trees, many others attain a considerable size, or are of economic value. The flowers are usually bright yellow except in a few cases indicated in the descriptions.

ON WATTLES AND WATTLE-BARK.

The word "wattle" is usually applied to the fleshy appendages hanging from the heads of such birds as fowls, and hence the Australian wattle bird receives its name, not from any association with the plants, but from the fleshy appendages which hang from its ears. The name wattle applied to Acacias is derived from the Anglo-Saxon word "watel," meaning a hurdle, and hence came to be applied to the osier, *Salix viminalis*, one of the common European Willows from whose flexible twigs hurdles were usually woven. The early colonists of New South Wales, using the branches of Acacia for similar purposes and for stiffening the mud walls of their huts, applied to these Acacias the name of Wattle. Strictly speaking, the name Wattle should not be used as a general term for all Acacias, but only to a certain limited number of species, and it would not be correct to apply it to Acacias which grow outside Australia.

With regard to the Wattle as the Australian national flower, this is of course entirely a matter for public opinion, and in time the latter is bound to crystallize around some particular plant. The Wattle has much in its favour as regards beauty and fragrance as a national floral emblem. From a botanical stand-point, however, the Acacias are not nearly as typically Australian as certain other genera, notably Eucalyptus. Out of a total of 300 species of Eucalypts only 25 occur elsewhere, and of these few species, all are natives of districts not widely separated

from Australia. On the other hand, out of a total of 780 species of Acacia known to science some 410 species are Australian, 130 species are native to Africa, and 240 species grow in other countries.

WATTLES FOR GARDENS AND PARKS.

Although Wattles or Acacias in general are well suited for garden cultivation, they are not suitable plants for street planting, particularly in large towns. For the most part they are apt to become begrimed and dingy in appearance in an atmosphere which is at all smoky. In addition, the duration of life is short and also irregular. The best selected and tended avenue of Acacias could rarely be relied upon for more than ten years, and after that time would need continual replanting as single trees died, so that the symmetry would always be broken by a series of gaps. Apart from the depredations of the borer beetles, the Acacias in general are liable to the attacks of various plant and animal parasites which may injure the trees or may completely distort their natural appearance. The natural habitat of most of our common Acacias is on the fringes of forests, in open forest glades, and generally among other trees wherever a sufficient opening occurs. They do best in fact when given a certain amount of protection by other vegetation. This applies particularly to the species with tender leaflets, and to a somewhat lesser extent to those with large flat phyllodes. The species with prickly or needle-like leaves on the other hand stand exposure much better, but have no special decorative or economic value for the most part.

ECONOMIC VALUE OF ACACIAS.

Acacias have both a direct and an indirect economic value. Owing to the fact that they are plants which bear nitrogen-assimilating root tubercles, they are important agents in maintaining the nitrogenous constituents of a fertile soil, and hence in making good the loss occasioned by forest fires. The hard seeds of various species of Acacia are able to remain living in the soil for long periods of time. The following are a few of the longest records obtained by me for different species of Acacia whose seeds had been kept dry for the periods of time mentioned :—

	Age.	Germination.
	Years.	Per Cent.
Acacia acinacea	51	4
	40	55
,, *alata*	30	4
,, *aneura*	20	56
,, *armata*	51	11
,, *bossiaeoides*	57	3
,, *brachybotrya*	57	4
,, *calamifolia*	18	80
,, *dealbata*	15	65
,, *decurrens*	17	63
,, *diffusa*	59	10
,, *doratoxylon*	20	6
,, *elata*	30	16

Economic Value of Acacias.—*continued.*

—	Age.	Germination.
Acacia		
„ *Farnesiana*	15	5
„ *glaucescens*	20	46
„ *lanigera*	20	20
„ *leprosa*	51	28
„ *longifolia*	52	21
„ „	68	5
„ *lunata*	48	8
„ *melanoxylon*	51	12
„ *Merrallii*	10	6
„ *montana*	58	2
„ *myrtifolia*	55	5
„ *neriifolia*	17	4
„ *nervosa*	30	4
„ *Osswaldii*	16	50
„ *penninervis*	67	50
„ *pentadenia*	30	3
„ *pycnantha*	16	55
„ *Senegal*	51	7
„ *Simsii*	31	15
„ *suaveolens*	51	4
„ *verniciflua*	41	4

In each sample of air-dried seeds it is the hard seeds which last longest, and in the soil it is only these hard, non-swelling seeds which can last for any length of time. In my paper on the "Longevity of Seeds," I have used the term "macrobiotic" to denote seeds of this character which are specially adapted for dispersal in time rather than in space.*

To some extent these macrobiotic seeds are adaptations to bush fires, which were probably of common occurrence long before the advent of civilized or even uncivilized man, and must have been far more frequent when the lava was flowing from the volcanoes of Victoria than at present.

Such bush fires, after burning off the humus more or less, not only partly expose the seeds, but leave behind an alkaline ash which the next rain falling on the warm ground aids in softening the coats of the hard seeds and bringing about their germination. When the ash is abundant and very alkaline the seedlings may be killed, but the majority will survive. In addition, slight charring of the surface of the seed makes it permeable to water without necessarily destroying the vitality of the contents. The Acacias or other leguminous plants, by the aid of their root nodules, can grow in soil from which all, or nearly all, the humus has been burnt away, and the source of nitrates hence removed. They steadily enrich the soil again and produce the conditions for the growth of large forest trees. These, if destroyed by a devastating bush fire, may once more be replaced by the humus-forming Acacias, &c., whose seeds have lain dormant in the soil during part, at least, of the growth of the forest.

* "See "Longevity of Seeds" in Proc. Roy. Soc. Vict. 21 (N.S.) Pt. 1, 1908.

I have, in fact, found Acacia seeds deeply buried in the soil of gum forests, where no other signs of their presence could be seen, and where no other Acacias were present within a mile. In addition, the following data may be given of the number of germinable Acacia seeds per 2 inch cube of soil found at various depths under old Acacias growing in undisturbed primeval bush.

Species	Depth. (Inches.)	Seeds present in 8 cubic Inches.	Number Germinable.	Germination Per Cent.
Acacia dealbata	3	28	26	93
„ „	6	17	13	77
„ „	9	16	10	63
„ „	12	11	9	82
„ „	18	3	3	100
„ *stricta*	4	1	1	100
„ „	8	2	2	100
„ „	12	..	..	..
„ *leprosa*	6	28	24	86
„ „	12	15	14	93
„ *melanoxylon*	4	11	10	91
„ „	8	5	4	80
„ „	12	2	2	100
„ *longifolia*	6	2	2	100
„ *var. mucronata*	10	..	..	..
„ *verticillata*	4	32	26	81
„ „	8	5	4	80
„ „	12	4	4	100

A square pole of such soil would in the top 18 inches, in some cases, contain sufficient germinable seed to stock several square miles of territory, so that the amount of margin allowed for accident is very great, and even a very low percentage of germination would suffice to re-cover the soil in the original vegetation after the severest bush fire. The percentage germinations are high, because as soon as the seed becomes permeable in the course of time and swells it either germinates or dies, so that in the deeper layers the only seeds found are likely to be hard macrobiotic ones. In fact, all the seeds found in the soil below the surface needed treatment with sulphuric acid to produce swelling and germination. Once they are swollen, the seeds are incapable of remaining living in a latent condition for any length of time without germinating, and this applies generally to the seeds of *Leguminosae*, whether cuticularized or not.

Hence, it is not surprising to find that it is has been found possible to establish a breakwind of Acacias on land where they had previously grown by merely fencing off a broad strip of land, letting a fire run over the surface, and then ploughing. Sufficient seed was present in the surface soil to germinate under this treatment and establish a good windbreak of Acacias without any planting or seeding being necessary. It will, of course, only succeed on ground where Acacias were formerly abundant, and the interval of time since Acacias were originally present must not be too great, probably not much more than 50 years.

On new ground, acacias can only be established either by planting or sowing seed. Every sample of acacia seed will contain a variable percentage of hard seed according to the species and to the conditions under which the seed ripened, and occasionally all, or nearly all, the seed in a particular sample may be hard.. The hardness is due to the impregnation of the outer skin, either the cuticle or also part of the epidermal layers, with a waxy substance, making the seed impermeable to water. If a little nick is made in the skin with a file, water enters the seed at that point, making it begin to swell, and separating the particles in the wax layer so that the whole seed is able to absorb water and swell. The same effect may be produced by soaking the seeds in concentrated sulphuric acid for one to six hours until the waxy layer is eaten away, and then washing them well with lime water and then pure water to remove or neutralize any traces of acid adhering to the skin. This method needs some care in its application, since the seeds must not remain either too long or too short a time in the acid, and this is best determined by a previous trial of a small sample. It is in all cases best to test the seed by soaking in water a few seeds for a couple of days or so, and noting how many swell and how many become hard. If only 10 per cent. or so of the seeds remain hard, it is not worth while treating the bulk at all, but if only a minority of the seeds swell after two or three days in water, then, unless the hard seeds are softened, there will be a great waste, since it is usually the hard seeds which give the best percentage germination when softened.

The simplest method of softening the seed is to drop them into water which has just boiled, and then to leave them in the water until it is cold. Seeds treated in this way should be planted at once, whereas those treated with sulphuric acid or filed can be kept dry for a considerable length of time. Filing the seeds, however, is, of course, only possible where small quantities are used.

Sowing seeds broadcast on ploughed or burnt land involves a considerable waste of seed, and is not always satisfactory in its results. Planting seedlings or individual seeds appears at first a more expensive and troublesome way of establishing a plantation, but is in the long run more satisfactory in its results, and enables the plants to be spaced out the proper distance apart without any subsequent thinning being necessary. If, however, the seedlings are grown in masses in trays, they are apt to suffer when planted owing to the disturbance of their roots. On the other hand, growing singly in pots in the ordinary way means considerable expense. For raising seedling trees on a large scale, the Forests Department uses a very cheap, ingenious, and indestructible pot. This consists of a strip of thin metal (tin, zinc, or galvanized iron may be used) something like a clerical collar, but shorter and broader, and with the free ends bent over, one inwards and one outwards, so as to form an interlocking flange. When bent round and the flanges interlocked, it forms a flower pot with sloping

sides but no bottom. As it stands on a slab no bottom is necessary, and by the time the seedlings are large enough to plant out, the roots have bound the soil in the pot together. When planting a little lateral pressure unlocks the flanges, the strip of metal unrolls, and the roots, with the soil around them can be spread out and planted with a minimum of injury. Another method is to raise seedlings in short lengths of bamboos filled with soil, simply splitting the bamboo and planting the whole in the soil, when the seedling is old enough. The tubes should be 4 inches to 6 inches long and hollow throughout. If the tube is already soft it need not be split before planting. Where preferred, however, plantations may be established by broadcasting the seed. In the case of the "Golden Wattle," *Acacia pycnantha*, ploughing to a depth of 6 inches or so and broadcasting half a pound of seed to a quarter of a bushel of sand per acre is recommended. The seed may be covered to a depth of about 1 inch by using a light harrow if the land is rough, or a brush harrow if sandy. The sowing of the seed may take place during autumn or winter in light well drained soils, but in heavy, wet, cold land it is best to delay sowing until springtime. Frequently, in thin or patchy forest land, the patches may be filled up with acacias by burning away the undergrowth and putting in seeds at distances of 8 feet to 10 feet.

WATTLE-BARK.

The best wattle-bark is usually obtained from wattles grown under the shelter of larger trees, but it is, of course, more difficult to protect isolated trees from fires, cattle, and bark-strippers, than to protect plantations.

The cultivation of wattles for wattle-bark has not only been taken up with eagerness in South Africa, but also in other countries. Thus, Black, Green and Golden Wattles yielding respectively 40 per cent., 22 per cent. and 30 per cent. of tannin are recommended for cultivation in Sicily; and at Palermo, *Acacia penninervis* (45 per cent. of tannin), *Acacia saligna* (30 per cent. of tannin), and *Acacia melanoxylon* (20 per cent of tannin), have already been grown with success. In addition, in German East Africa *A. mollissima* and *A. decurrens* have been grown for more than 30 years, and the bark was found to yield 44 per cent. and 38 per cent. of tannin, respectively. The seed yielded by these wattles was found to be of first rate quality, and it was exclusively used for propagation in German East Africa.

Wattle-bark can now be grown in various parts of the world as well and as profitably as in its native home, Australia. In other words, the original monopoly has been lost; and if Australia is to regain predominance in regard to this commodity, it can only be done by the exercise of the same foresight, energy, and business qualities which have enabled other countries to become competitors in the world's market.

In three important respects wattle-barks are superior to most tanning materials. Firstly their cost in regard to the amount of tannin available is low, and it is the most soluble tannin which is the most valuable. The less soluble portions are more difficult to extract, and produce a poorer leather. Secondly, any precipitation taking place in a tanning liquor on standing, not only hinders the tanning action on leather, but also represents the loss of a certain amount of tanning materials in the extract. In the following table Professor Paessler gives a comparison between different tanning materials, and in the last column is included the amounts of insoluble matter deposited in tanning extracts of standard strength after standing for 60 days. As can be seen, the wattle-barks are especially satisfactory in this respect. Finally in its power of producing a heavy leather, wattle-bark comes second only to quebracho wood.

—	Average Cost per ton in 1911.	Average per cent. of Tannin Present.	Average Cost of Tannin per lb.	Insoluble Matter Deposited in 60 days.
	£ s. d.		d.	
Oak Bark..	5 6 8	9·0	$6\frac{1}{4}$	7·5
Oak Bark Extract	12 11 2	25·0	$5\frac{1}{2}$	11·5
Valonia	12 11 2	27·0	$5\frac{1}{2}$	29·0
Quebracho	6 1 7	19·0	$3\frac{1}{2}$	3·4
Divi-Divi	12 3 10	28·0	$3\frac{1}{2}$	29·0
Wattle Bark*	10 3 2	33·0	$3\frac{1}{4}$	0·0
Myrobalans	7 12 5	30·0	$2\frac{3}{4}$	24·0
Mangrove-bark	7 12 5	38·0	2	0·0
Gambier	..	..	..	0·0
Galls	..	..	..	16·0

There is a deficiency in the local production of wattle-bark which should be made good by an increased planting of suitable acacias. If, however, this is to be profitable, it must be done on practical and business lines; and there are certain pests, particularly the "Fire Blight," *Paropsis orphana*, which have been responsible for the destruction of or serious damage to large plantations intended for the production of wattle-bark. This pest appears to be specially injurious to the common Black Wattle, *Acacia decurrens*, and to do little or no damage to the Golden Wattle, *Acacia pycnantha*. It is possible that if in the large plantations mentioned, the chess board system of planting had been adopted, and the acacias planted in small squares surrounded by other trees, there would have been greater scope for checking the spread of the pest. There are, however, risks of this kind in all natural industries, and the fact that acacias have thrived so well in Victoria for ages past, and have survived their numerous foes, shows that it is merely necessary to repeat the proper conditions for their growth to attain success in wattle cultivation.

* The cost, in recent years at least, has varied from £12 to £20 per ton, and the price of other tanning materials has altered similarly.

The best species are the Golden, Black, and Green Wattles (*A. pycnantha, decurrens, mollissima*). When sufficient naturally grown plants exist, the bark of the Silver Wattle (*Acacia dealbata*) is worth collecting, and is used for rough tanning. It is not, however, much used locally, is hardly worth exporting, and is certainly not worth planting in comparison with the better wattles. In all cases the best bark appears to come from trees growing naturally in mixed forests.

Trees are ready to strip when they have grown to good upstanding trees with sufficient surface of the main trunk smooth and well grown. Usually trees six or seven years old are in this condition, and ready for stripping; but to some extent the age at which the tree is ready for stripping will depend upon the species of Acacia and the district and conditions under which it is grown. Under favorable circumstances Wattles grow with great rapidity. Thus a tree of *Acacia mollissima* grown in the Herbarium grounds attained a diameter of 26 inches at a height of 1½ feet above ground, and a height of 25 feet in four years, and would have been quite ready for stripping in that time.

It is when Acacias are approaching adult size that they seem to become especially prone to the attacks of the "Woolly Blight," "Borer Beetles," "Fire Blight," &c., and they appear to be especially prone to the first named when growing in unnaturally exposed situations. In addition, beyond a certain age, the bark appears to deteriorate both physically and chemically from an economic stand-point.

The best time to strip the bark is in the spring and early summer, when the sap is rising. At that time, not only does the bark come off more easily, but it is in better condition for tanning purposes. When stripped it should be dried in thin layers of strips laid on rough frames made of wood or branches and raised about 1 foot above ground. The strips when fully dried and bound in bundles are ready for sale as the commercial article, wattle tanning bark. They should on no account be bound in bundles or stacked until quite dry, since otherwise they become mildewed, dark coloured, and deteriorate considerably in value. Neglect of this simple precaution causes much loss.

There is no doubt that there is a considerable amount of poor class land at present being put to little or no use, which might well be devoted to the cultivation of Wattles. The suggestion has been made to plant Wattles along the railway lines. It is not likely that any one would attempt to grow Wattles for profit on the carbonaceous sandstones of Gippsland, which affords rich pastures for dairying, or on fertile volcanic soils suitable for cultivation; but it may be as well to mention that Wattles grown on such soils tend to be of a spindly nature with a thin bark inferior for tanning purposes. As a rule, the best bark is obtained from granite formations, while that from ironstone pebbles with a clay

subsoil approaches and somewhat equals it. The bark from trees grown in sandy loam usually contains a little less tannic acid, but affords a good quality bark; and, in fact, yields the greater proportion of the supplies grown in Victoria.

The principal districts from which naturally-grown bark is obtained are the Dartmoor district on the Lower Glenelg, the Avenel, Seymour and Tallarook districts, the Briagolong and Glenmaggie districts in East Gippsland. The Gippsland bark is thinner, and not quite so good as that from the other localities.

The general trend of the facts mentioned above is to show that there is an opening for an increased growth of Wattles for tanning bark in Victoria, but that there are certain risks attached to the cultivation on a large scale, and that success is rewarded by reasonable but not by extravagant profits. Apparently, the proper position is that it should enable land-owners to extract a profit from poor land they could not otherwise profitably utilize, and be more as a side line than as a mainstay of support. The cultivation of Wattles does not appear to offer any openings to the man of small capital, to whom quick returns are essential.

ACACIA.—(*cont.*)

Acacia rigens, A. Cunn. "Nealie" or "Wallaby Acacia." (Plate LX.)

Description.—A tall shrub of 15 feet to 20 feet in height, either quite glabrous or minutely hairy, with somewhat angular branchlets. Phyllodes linear, pointed, rather stiff, straight or incurved, and usually 2 inches to 3 inches long. Flowers in globular, shortly-stalked heads of about 20 flowers, mostly five-partite, with spoon-shaped sepals and smooth petals. The pod is linear, one and a half lines broad, and contains ovate seeds. Aril prominent and twice folded.

Habitat.—A native of North-West Victoria in arid country along the Murray and Wimmera; also in South Australia and New South Wales.

Timber.—Too small to be of economic value, but it often grows where firewood is scarce and is useful in checking wind erosion in dry districts.

Acacia calamifolia, Sweet. "Wallowa" or "Reed-leaved Acacia." (Plate LXI.)

Description.—A tall glabrous shrub 15 feet to 20 feet high, with slender terete branches and linear, pointed phyllodia, 2 inches to 4 inches long and nearly one line broad, the tips often curved. The globular flower heads are usually grouped in threes or fours in a short raceme on rather long, slender stalks. Each head has numerous mostly five-partite

Plate LX.—*Acacia rigens*. The Nealie.

A. Twig with flowers.
B. Twig with fruit.
C. Expanded flower.
D. Carpel.
E. Front and back view of a stamen.
F. Pollen-cluster.
G. Lower portion of a fruit valve with seeds.
H. A seed separated.
I. Unexpanded flower.
J. Bracts.
K. Longitudinal sections of seeds showing aril.
L. Flower head (in bud).
M. Tip of phyllode.

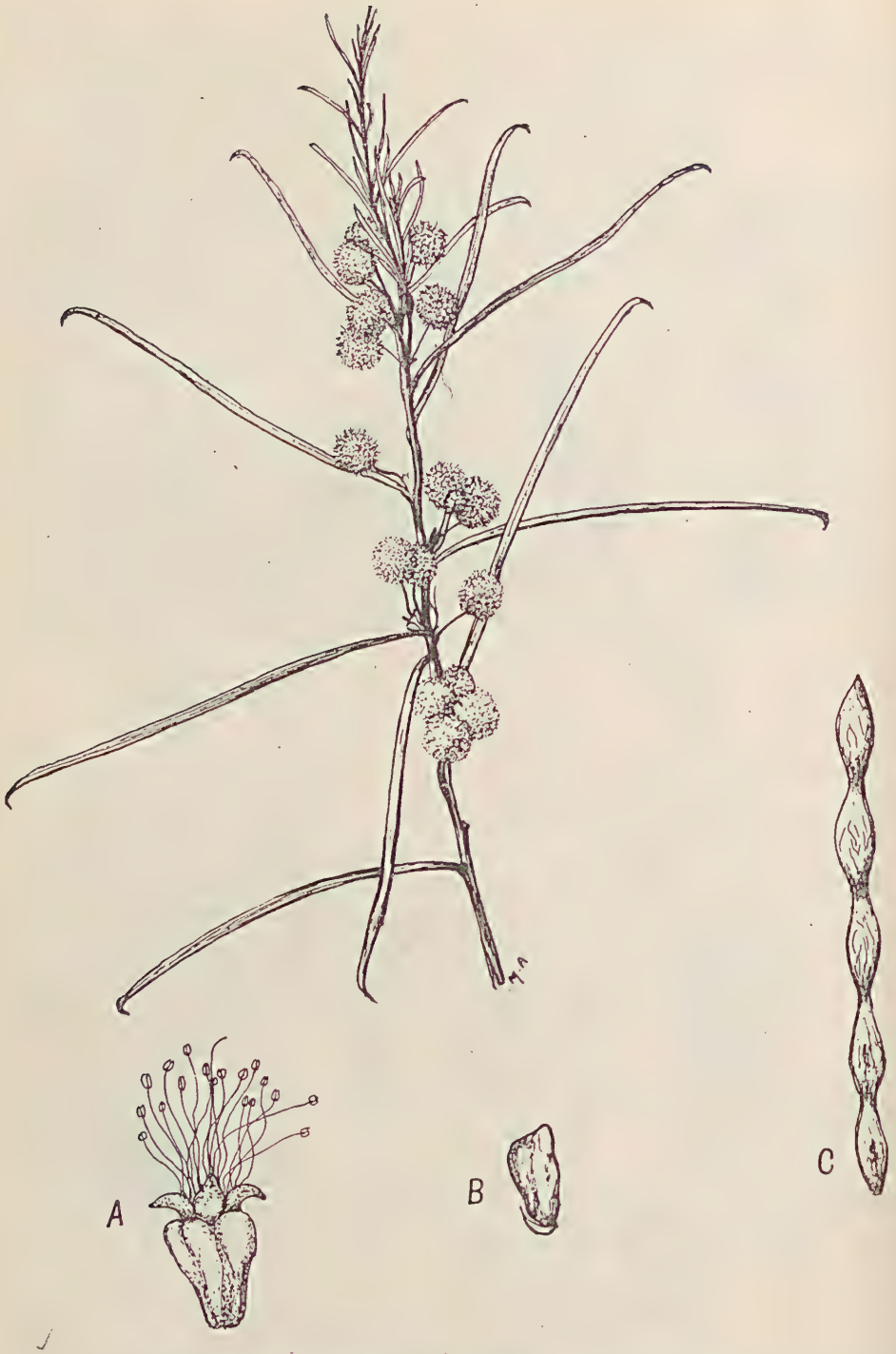


Plate LXI.—*Acacia calamifolia.* The Wallowa.

A. Flower.
B. Seed.
C. Fruit.

Plate LXII.—*Acacia verniciflua*.. The Varnish Acacia.

A. Flowering shoot.
B. Flower.
C. Pod.
D. Seed with basal aril.

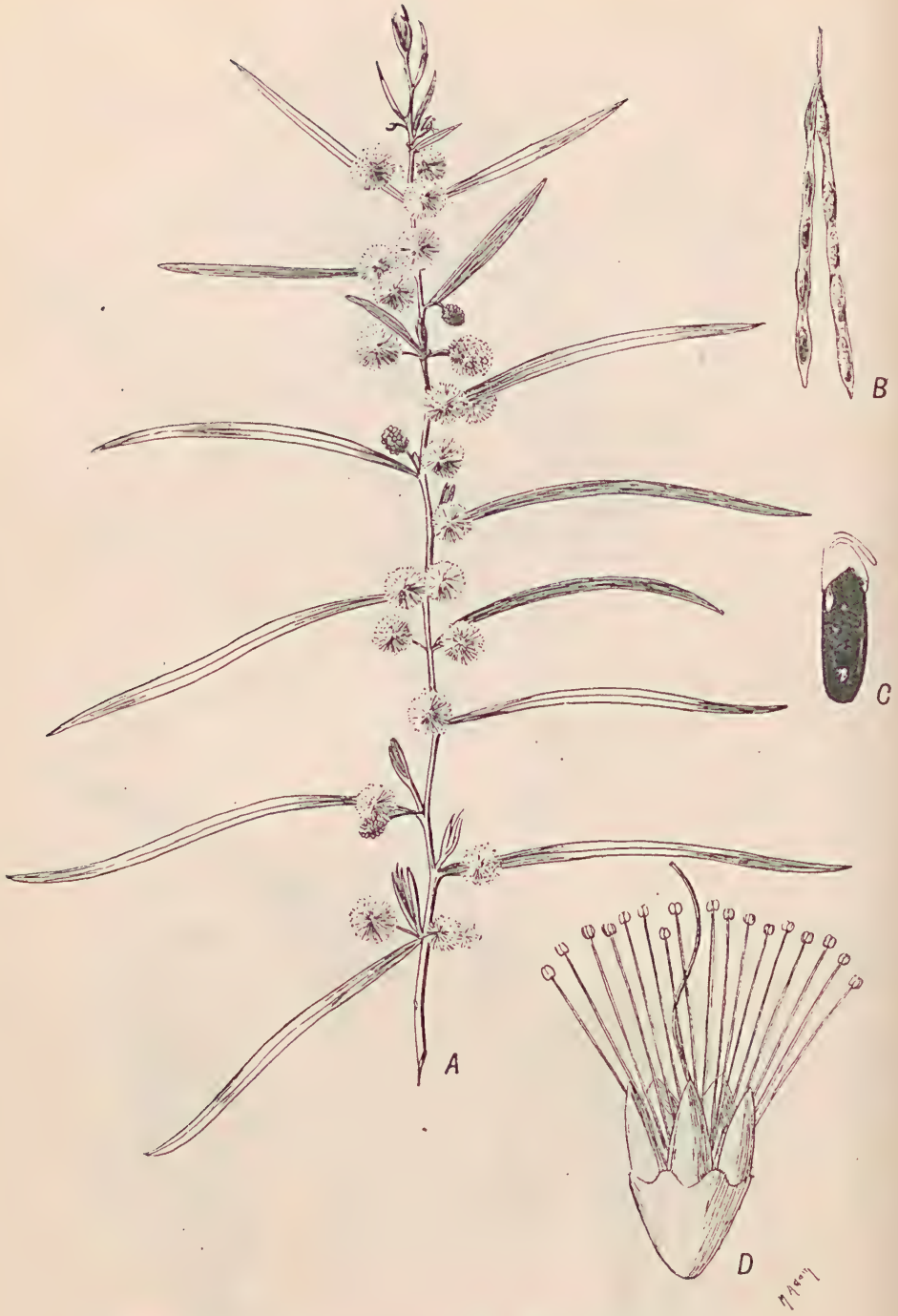


Plate LXIII.—*Acacia leprosa.* The Leper Acacia.

A. Flowering shoot.
B. Pod.
C. Seed with basal aril and bent funicle.
D. Flower.

flowers. The calyx is thin and transparent with short, ciliate lobes. The petals are smooth and separate. The pod is usually curved, often 5 inches to 6 inches long, and two to two and a half lines broad, with oblong seeds and a rather small aril.

Habitat.—A native of the North Western district, but rarely very abundant ; also in New South Wales, Queensland and South Australia.

Timber.—As in the preceding. The young shoots are browsed by stock in time of scarcity.

Acacia verniciflua, A. Cunn. "Varnish Acacia." (Plate LXII.)

Description.—A tall, resinous, viscid shrub 15 feet to 20 feet high, and with oblong to linear lanceolate phyllodia, 2 inches to 4 inches long. The globular heads occur in pairs or clusters on short stalks. The flowers are five-partite, with a turbinate calyx, about half as long as the smooth, united petals. The pod is linear, two to three lines broad with oval longitudinal seeds, and a rather small aril.

Habitat.—A native of the South-West, South, North-East and East of Victoria, widely distributed in mountain and forest regions on rocky hills, &c. ; also in New South Wales, South Australia and Tasmania.

Timber.—Too small to be of much economic value. The name is derived from the viscid surface of the phyllodes and young stems.

Acacia leprosa, Sieb. "Leper Acacia." (Plate LXIII.)

Description.—A tall shrub or small tree 15 feet to 30 feet high, with pendulous branches and narrow, linear lanceolate, mostly acute phyllodia 1½ inch to 3 inches long. The globular heads occur in pairs or clusters on stalks about ¼ inch long. The flowers are mostly five-partite, with a truncate calyx half the length of the corolla, and petals united to the middle. The pod is curved or rarely straight, flat, two to two and a half lines broad. The oval-oblong seeds have a well-marked aril.

Habitat.—A native of the South, North-east, and East, growing well in the Dandenong and Gippsland Ranges ; also in New South Wales.

Timber.—Too small to be of much economic value. The name is derived from the unpleasant odour of the plant.

A. Victoriæ. Bent.

Acacia sentis, F.v.M. "Bramble Acacia." (Plate LXIV.)

Description.—A tall shrub or small tree 15 feet to 20 feet high, glabrous or nearly so. The phyllodia are lanceolate oblong or linear from ¾ inch to over 1 inch long and two to three lines broad, often with recurved hook-like tips (hence "Bramble" Acacia). The globular heads of 20

Plate LXIV.—*Acacia sentis*. The Bramble Acacia.

A. Flowering shoot.
B. Fruits.
C. Flower.
D. Seed.

Plate LXV. *Acacia penninervis*. Hickory Wattle.

A. Twig with flowers.
B. Twig with pod.
C. Enlarged flower.
D. Carpel.
E. Unopened flower.
F. Bract.
G. Unopened head of flower buds.

Plate LXVI.—*Acacia retinodes.* The Wirilda.

A. Flowering shoot.
B. Flower.
C. Seed, with basal aril.
D. Fruiting shoot.

to 30 flowers are borne on rather long slender stalks, singly or in pairs in the axils of the phyllodes. Sometimes the latter are undeveloped and a terminal raceme results. The flowers are mostly five-partite with linear spathulate, free sepals and smooth pointed petals. The pod is thin, flat, ½ inch to ¾ inch broad, with broadly ovate seeds and no prominent aril.

Habitat.—A native of North-Western Victoria, on low sandhills and arid saltbush plains, and towards the junction of the Murray and Darling; also in New South Wales, Queensland, South and Western Australia.

Timber.—Too small to be of any economic value.

Acacia penninervis, Sieber. "Hickory Wattle." (Plate LXV.)

Description.—A glabrous tree 30 feet to 40 feet high, or even more, with a diameter of 1½ feet to 2 feet, with angular branchlets. The phyllodia vary from oblong to lanceolate-falcate and more or less pointed, usually 3 inches to 5 inches long by 1 inch broad, but often much longer. One main nerve with finely penniveined lateral nerves, usually with a prominent gland below the base. The small globular heads of about 20 flowers occur several together in rather short, but loose racemes. The flowers are mostly five-partite with a truncate or shortly-toothed calyx, and four petals twice the length. The pod is flat, straight or curved, 4 inches to 5 inches long and ½ inch broad with ovate seeds. Funicle coloured and twice folded around the seed or on one side of it.

Habitat.—A native of the North-East and East of Victoria, mainly on granitic ranges and mountains on the Broken, Ovens, and Snowy Rivers; also in New South Wales, Queensland, and Tasmania.

Timber.—Dark brown or almost black to light brown. Hard, strong, tough (hence the name "Hickory"), close-grained, polishes well and with good figure. Often shows fiddle-back grain. Resembles black-wood. Useful for furniture and cabinet work. A valuable timber for fine purposes. Sap-wood pale in colour. A cubic foot weighs 51 lb. It forms good axe and tool handles, and particularly when grown on high, stony ridges, where it is usually not attacked by the borer. The dry bark contains from 25 per cent. to 35 per cent of tannin.

Acacia retinodes, Schlech. "Wirilda." (Plate LXVI.)

Description.—A moderate-sized tree 10 feet to 25 feet high, usually glabrous. The phyllodia are linear-lanceolate, more of less falcate, much narrowed towards the base, mostly 3 inches to 5 inches long, 1-nerved and finely penniveined. The racemes are much shorter than the phyllodia and are usually branched with several, often ten to twenty, small, shortly

Plate LXVII.—*Acacia pycnantha.* The Golden Wattle.

A. Flowering shoot with phyllodes.
B. Head of flower buds.
C. Flower.
D. Bract.
E. Fruit.

Plate LXVII.—*Acacia hakeoides.* The Hakea Acacia.

A. Flowering shoot.
B. Shoot with ripe and dehiscing pods.
C. Flower.
D. Unexpanded head of flower buds.
E. Seed, on the left, in section showing basal aril and funicle.

stalked, globular heads of mostly five-partite flowers. The calyx has broad ciliate lobes. Fruit 5 inches to 8 inches long and three to four lines broad with oblong longitudinal seeds with a twice-folded encircling funicle.

Habitat.—A native of the North-West, South-West and South-East of Victoria, Port Phillip, and on grassy ridges and open valleys throughout the State; also in South Australia.

Timber.—Of no special economic value.

Acacia pycnantha, Benth. "Golden Wattle." (Plate LXVII.)

Description.—A small glabrous tree 15 feet to 35 feet high and 6 inches to 10 inches diameter. The phyllodia are lanceolate-falcate, obtuse or somewhat acute, much narrowed towards the base, 3 inches to 6 inches long and rather thick. The larger phyllodes are often an inch broad at the middle and all have one main nerve and penniveined lateral veins with nerve-like margins. The racemes are short with a few dense globular heads of 50 to 100 deep yellow flowers, mostly five-partite. The stalks of the raceme and heads are rather stout. The calyx is shortly lobed and about one-third shorter than the corolla. The tips of the sepals are ciliate. The pod is straight or curved, several inches long, and about three lines broad with oval to oblong seeds. Funicle short, straight or slightly folded.

Habitat.—A native usually of the moister districts of Victoria and widely planted; also in New South Wales and South Australia.

Timber.—Pale, fairly strong and tough, but usually small and very liable to the attacks of longicorn beetle larvae (borers). It makes fairly good small poles and is of very rapid growth. The bark is one of the best sources of tannin. (See Wattles and Wattlebark, p. 136). It is of rapid growth, will grow on poor soils or near the coast, but prefers hilly slopes with moderate but not excessive moisture, and does not thrive at elevations exceeding 2,000 feet. It grows well on clay subsoils, but is sensitive to frost, particularly in easterly aspects, and is easily killed by bush fires or damaged by borers. It has from half to two-thirds the rate of growth of the Black Wattle, is ripe for stripping from the sixth year, and will last ten to fifteen years on clay soils, and twelve to twenty years on sandy ones.

Acacia hakeoides, Cunn. "Hakea Acacia." (Plate LXVIII.)

Description.—A tall glabrous shrub growing to a height of 12 feet to 15 feet. The phyllodia are linear spathulate or narrow, oblong lanceolate, much narrowed at the base, 2 inches to 5 inches long, one-nerved and obscurely marked with longitudinal reticulations. The

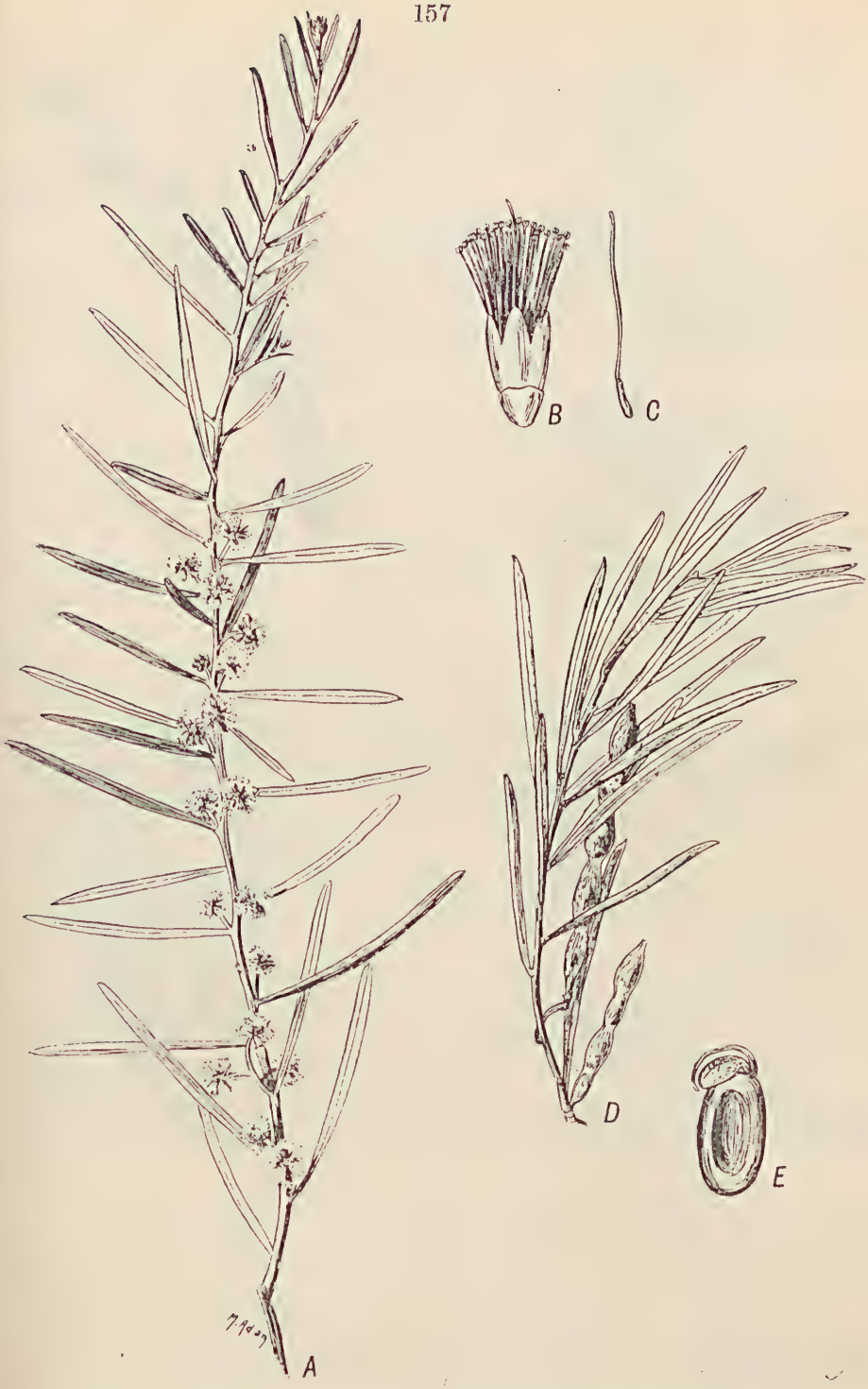


Plate LXIX.—*Acacia salicina.* The Willow Acacia.

A. Flowering shoot.
B. Flower.
C. Carpel.
D. Fruiting branch.
E. Seed with aril and funicle.

Plate LXX.—*Acacia buxifolia.* The Crescent Acacia.

A. Flowering branch.
B. Flower.
C. Pod.

racemes are shorter than the phyllodia and consist of a few globular heads each of about twenty five-partite flowers. The sepals are spathulate and half as long as the smooth or pubescent petals. The pod is flat, usually curved, two to three lines broad and with oblong, longitudinal seeds. The aril is prominent.

Habitat.—A native of North-West Victoria, in the Mallee and arid country near the Murray ; also in New South Wales and South Australia.

Timber.—Two small to be of economic value. The name is from a somewhat fanciful resemblance to Hakea.

Acacia salicina, Lindl. "Willow Acacia." (Plate LXIX.)

Description.—A small glabrous tree of drooping habit and 10 feet to 30 feet high, or a tall shrub of 8 feet to 10 feet. The phyllodia vary from narrow-elliptical to linear-lanceolate, are obtuse, usually straight, rather thick, 2 inches to 5 inches long and not above $\frac{1}{2}$ inch broad. The dense globular heads occur in clusters of two or three, occasionally reduced to one. Each head has twenty or more, usually five-partite, and pale yellow, flowers, with a short truncate calyx, entire or minutely toothed, and smooth petals. The pod is straight, 1 inch to 3 inches long and three lines broad with orbicular longitudinal seeds, the funicle scarlet and in several folds, or forming a prominent aril. It is sometimes known as eumung or cooba.

Habitat.—A native of North-West Victoria, usually in open forest country ; also over all the coastal regions of Australia.

Timber.—Dark brown, resembling blackwood, close-grained, tough and heavy, sap-wood small but with slightly more open interlocked grain and pale. Requires scraping before polishing. Useful for furniture, fittings, cabinet work, knobs, serviette rings, and small purposes. A cubic foot weighs 48 lb. when seasoned. Cattle eat the leaves and destroy young seedlings. The bark contains about 15 per cent. of tannic acid.

A dwarf variety with the pods constricted between the seeds is known as variety *Wayae* (*A. ligulata, Cunn*). The flowers are bright yellow.

Acacia buxifolia, Cunn. "Box-leaf" or "Crescent Acacia." (*A. lunata Sieb.*) (Plate LXX.)

Description.—A tall glabrous shrub with angular branchlets growing to a height of 12 feet to 15 feet, but usually only 3 feet to 6 feet. The phyllodia are linear spathulate, or narrow oblong-falcate or almost ovate but very oblique, rarely more than 1 inch long, and three to six lines

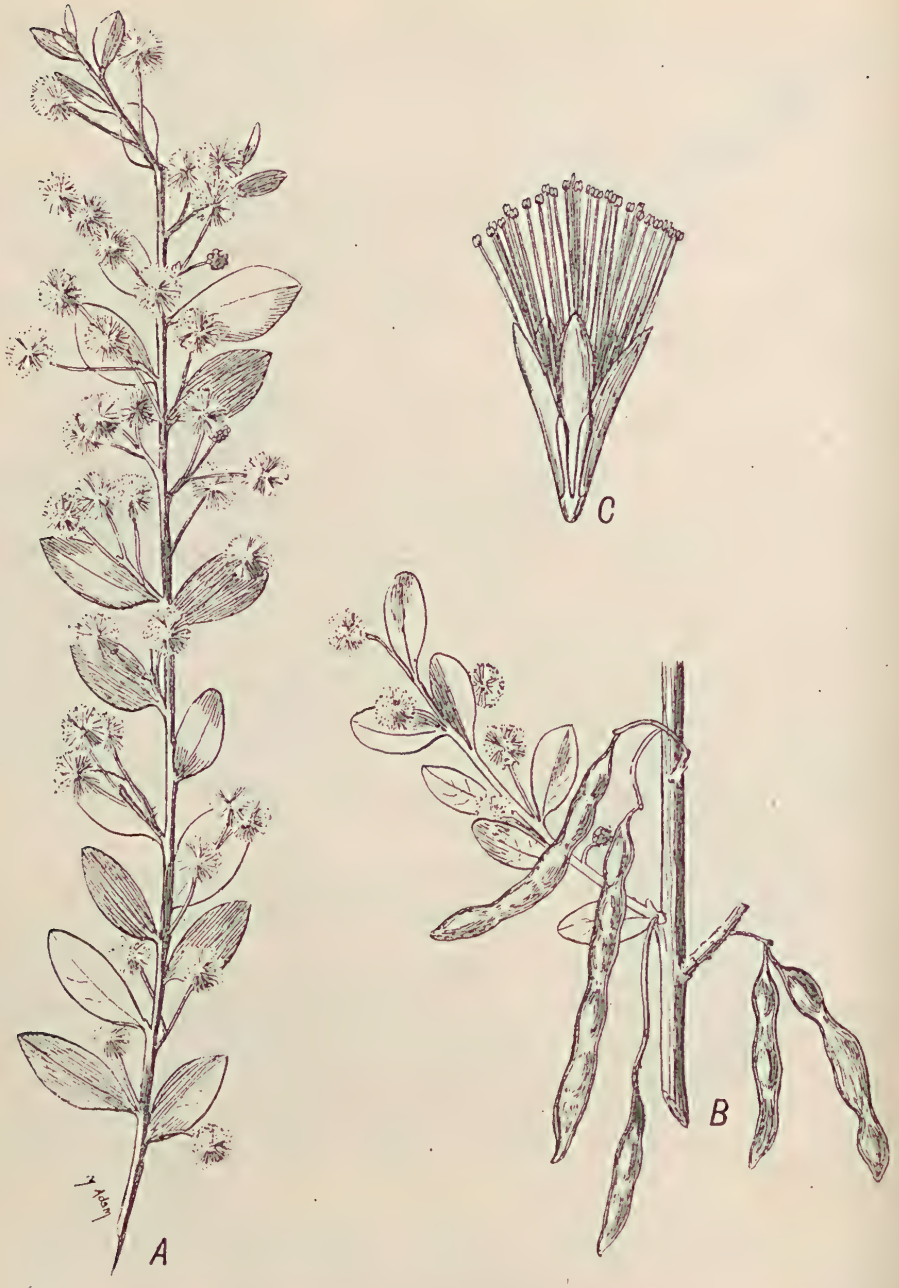


Plate LXXI.—*Acacia brachybotrya.* The Silver Mulga.

A. Flowering shoot.
B. Branch with flowers and fruits.
C. Flower.

broad, one-nerved and obscurely veined. The racemes are longer than the phyllodia, with several small heads of four to ten, or rarely more, comparatively large, mostly five-partite flowers. The calyx is short and broad, with truncate lobes, and the petals smooth. The pod is flat, straight, or curved, and three to four lines broad with oval longitudinal seeds. Funicle bent and thickened to a club-shaped aril obliquely to the base of the seed.

Habitat.—A native of the North-East Victoria and on barren scrubby ridges between Mayday Hills and the Ovens River. Also in New South Wales and Queensland.

Timber.—Too small to be of economic value except for firewood. Often grown as a garden shrub.

Acacia brachybotrya, Benth. "Silver Mulga." (Plate LXXI.)

Description.—A handsome shrub 4 feet to 10 feet high, rarely 15 feet high, often with a bluish or silvery or golden sheen, with obliquely ovate, obovate or oblong, obtuse or rarely mucronate phyllodia, ½ inch to 1 inch long, one-nerved and penniveined, lamina rather thick. The heads are either single on short stalks or two to five arising from a very short common stalk, each head with 20 to 50 mostly five-partite flowers. The sepals are linear, spathulate and free. The petals are smooth and free. The pod is linear, straight or undulate and three to five lines broad, with oblong longitudinal seeds, with a folded funicle dilated below the seed.

Habitat.—A native of the arid North-West regions of Victoria, not uncommon; also in New South Wales and South Australia.

Timber.—Too small to be of economic value except for small firewood. The bark contains 15 per cent. to 20 per cent. of tannin. Sheep eat the leaves. Often grown as a garden shrub.

Acacia pravissima, F.v.M. "Ovens Acacia." (Plate LXXII.)

Description.—A tall shrub or small tree 10 feet to 20 feet high, with numerous, broadly and very obliquely falcate, obovate or almost trapezoid phyllodia with the lower angle acute and the upper rounded, three to five lines, or rarely ½ inch long, and two-nerved. The racemes are longer than the leaves and consist of ten to twenty small globular heads, each with eight to twelve five-partite flowers. The calyx is small and shortly lobed. The petals are free, and smooth. The pod is flat with longitudinal seeds. The folded funicle forms a small oblique aril.

Plate LXXII.—*Acacia pravissima.* The Ovens Acacia.

A. Branch with phyllodes and flower heads.
B. Unopened head of flower buds.
C. Flower.
D. Seed.
E. Dehiscing fruit.

Plate LXXIII.—*Acacia myrtifolia.* The Myrtle Acacia.

A. Branch with phyllodes, buds and flower heads.
B. Branch with fruits.
C. Flower.
D. Seed.

Plate LXXIV.—*Acacia subporosa.* The River Acacia.

A. Branch with phyllodes and flower heads.
B. Branch with fruits.
C. Flower.
D. Unopened head of flower buds.
E. Seed, entire and in section, showing basil aril and bent funicle.

Habitat.—A native of the North-East and East of Victoria, in the valleys of the Australian Alps, and on the banks of streams descending from them at the foot of the Buffalo Ranges and on the Snowy and MacAllister Rivers; also in New South Wales.

Timber.—Too small to be of economic value.

Acacia myrtifolia, Willd. "Myrtle Acacia." (Plate LXXIII.)

Description.—A tall glabrous shrub 5 feet to 15 feet high, with acutely angular branches. The phyllodia are oblique or falcate, obovate to ovate-lanceolate, lanceolate or linear, 1 inch to 2 inches long and one-nerved. The racemes rarely exceed the phyllodia and consist of several almost sessile heads, each with only two, three, or more rather large four-partite flowers. The calyx is very short and hardly lobed or almost truncate. The petals are smooth and spreading. The pod is linear, curved, flattened, 1 inch to 2 inches long and two lines broad with oblong seeds. The funicle is short and forms a basal cup-shaped aril.

Habitat.—A native of North-West, South-West, South, North-East, and East of Victoria, frequently in barren places, in the lowlands as well as in the mountains throughout the State; also widely spread in the coastal regions of Australia, except in the extreme North.

Timber.—Too small to be of much economic value, but occasionally large enough to be used for turnery or small cabinet work.

Acacia subporosa, F.v.M. "River Acacia." (Plate LXXIV.)

Description.—A tree attaining a height of 30 feet to 40 feet, with slender branches, and linear lanceolate or linear, often slightly falcate phyllodia, 1½ inches to 3 inches or rarely 4 inches long, and from one line broad in the narrow variety, to three or four lines broad in other forms. Phyllodia linear to linear-lanceolate, often curved and with two or three slightly prominent nerves. The globular heads occur singly or in pairs on stalks ½ inch long and have each 20 to 30 mostly five-partite flowers. The calyx is lobed, shortly hairy outside, and not half as long as the petals. Pod 2 inches to 3 inches long, narrow, tapering to a point, rather thin, not at all, or not much, constricted between the seeds, which are oblong and longitudinal, with a small aril and a twice-folded funicle.

Habitat.—A native of the East of Victoria, in forest gullies on the barren range at the eastern boundary of the State; also in New South Wales.

Timber.—Of moderate size, not very abundant and apparently little used.

Plate LXXV.—*Acacia homalophylla.* The Yarran.

A. Branch with phyllodes and flower heads.
B. Branch with fruits.
C. Flower.
D. Unopened head of flower buds.
E. Seed showing bent funicle.

Plate LXXVI.—*Acacia Osswaldii.* The Umbrella Acacia.

A. Branch with phyllodes and flower heads.
B. Dehiscing fruit.
C. Flower.

Acacia homalophylla, A. Cunn. "Yarran." ("omalophylla" from "homalos," smooth was the original name as spelt by Cunningham. The rules of nomenclature justify the change to "homalophylla" (Plate LXXV.)

Description.—A small tree, 15 feet to 40 feet high, rarely exceeding 1 foot in diameter, greyish in colour. The phyllodia vary from narrow lanceolate to almost linear and are mostly falcate and 1½ inches to 3 inches long, by one to four lines broad, usually with a marginal tubercle near the base. The stalked dense, globular heads of mostly five-partite flowers occur in pairs, or in clusters on a short common stalk. The sepals are cuneate, or more or less united, and about half as long as the free petals. The pod is linear, two to three lines broad, with oval-oblong, longitudinal seeds, and constricted between them. Funicle much folded and forming a small oblique aril.

Habitat.—A native of the North-West of Victoria, on saltbush flats along the Murray; also in New South Wales, Queensland, and South Australia.

Timber.—Dark brown, close-grained, very hard, strong with an aroma of violets. Sap-wood narrow, white. Polishes well and shows a good figure. Useful for furniture, veneers, cabinet work, tool and whip-handles, rulers, carving, and for bearings to stand hard wear. A cubic foot weighs about 80 lb. It was used by the blacks for spears and boomerangs. Stock eat the foliage and hence keep down seedlings, but owing to its unpleasant smell only camels eat it freely. The wood forms good fuel.

Acacia homalophylla is sometimes known as Gidgee and also as the "Myall." The true Myall is *A. pendula*, but the name is also applied to other acacias with a dark wood. *A. pendula* has a valuable, rather hard wood, dark with narrow light lines; valuable for cabinet work and turnery and also used for the spokes of gun-carriage wheels.

Acacia Oswaldii, F.v.M. "Umbrella Acacia." (Plate LXXVI.)

Description.—A rigid bushy shrub, 15 feet to 20 feet high, with slightly angular branchlets. The phyllodia are falcate-lanceolate, varying to linear or oblong-lanceolate, mostly 1½ inches to 2 inches long with a sharp point. The flower heads are small, globular, sessile or nearly solitary or in pairs or clusters, each head of ten to fifteen mostly five-partite flowers with free sepals and petals. The sepals are linear, or spathulate. The petals are usually hairy. The pod is much curved, twisted, three to four lines broad, hard or almost woody with large ovate seeds.

Plate LXXVII.—*Acacia stenophylla.* The Eumong.

A. Flowers.
B. Fruits.
C. Lower portion of a fruit valve with a seed.
D. Expanded flower.
E. Longitudinal section of seed.
F. Unexpanded flower.
G. Bracts. H. Carpel.
I. Front and back view of stamens.
J. Head of unexpanded flowers.

Habitat.—A native of North-West of Victoria, on arid country along the Murray from the Murrumbidgee to western frontier; also in New South Wales, Queensland, South Australia, and Western Australia.

Timber.—Too small to be of economic value.

Acacia stenophylla, Cunn. "Dalby Myall." "Eumong." (Plate LXXVII.)

Description.—A very hard-wooded tree, 40 feet to 60 feet high, glabrous with angular branchlets. The phyllodia are long, linear acuminate or falcate, 6 inches to 1 foot long, about 2 to 2½ lines broad with numerous parallel nerves. The globular heads of 20 to 30 or more, mostly five-partite flowers, occur on stalks under ½ inch long, sometimes singly but usually in short racemes of three to six heads. The calyx has broad ciliate lobes and is half as long as the corolla of hairy petals. The pods are long and rather broad (usually four to five lines) with ovate seeds, and much constricted between the seeds. Funicle folded and forming an obliquely cup-shaped basal aril.

Habitat.—A native of North-West Victoria along the banks of the Murray; also in New South Wales, Queensland, and South Australia.

Timber.—Dark reddish brown to almost black, hard, heavy, close-grained, suitable for cabinet work, furniture, veneers and bearings.

Acacia melanoxylon, R. Br. "Blackwood." (Plate LXXVIII.)

Description.—A large tree with hard, dark wood, 40 feet to 100 feet high and 2 feet to 3 feet in diameter, with angular branchlets, often flowering while still young. The phyllodia are falcate, oblong, or almost acute and rather leathery. The heads are large and globular on stalks three to four lines long, solitary or a few together in simple racemes. Each head has 30 to 50 mostly five-partite flowers, very pale or white. The calyx is more than half as long as the corolla, thin and bluntly-toothed. The petals are united to about the middle. The pod is elongated, three to four lines broad, often curved into a circle and with orbicular-oblong seeds. The reddish funicle is long and often partly encloses the seeds in a double fold.

Habitat.—A native of the North-West, South-West, South, North-East, and East of Victoria on rich soil in valleys or grassy ranges, but absent from dry districts and ascending to a considerable elevation; also in New South Wales, South Australia, and Tasmania. It is usually of rather slow growth but under good conditions may attain 20 feet and nearly 1 foot diameter in five to seven years.

Plate LXXVIII.—*Acacia melanoxylon*. The Blackwood.

A. Branch with phyllodes and flower heads.
B. Flower.
C. Portion of fruit with seed partially enclosed by curved funicle.
D. Curved fruits.

Plate LXXIX.—*Acacia implexa*. The Lightwood.

A. Branch with phyllodes and flower heads.
B. Unopened head of flower buds.
C. Individual bud.
D. Flower.
E. Bract found at base of each flower.
F. Flower opening out showing—
   (*a*) Calyx
   (*b*) Corolla
   (*c*) Carpel (stamens removed).
G. Pods.
H. Seed with twisted funicle.

Timber.—Brown to dark brown with lighter bands. Close-grained with a beautiful figure and often fiddle-back grain. Polishes and seasons well and one of the most valuable timbers for fittings, carriage and boat building, gun-stocks, railway cars, cabin and shop fittings, cabinet work, three-ply, and veneers. A cubic foot weighs 40 lb. to 45 lb. when seasoned. Transverse breaking stress (3 feet by 3 inches by 3 inches) 6,000 lb. to 6,500 lb. The weight varies a good deal according to the locality and rapidity of growth, the extreme limits being from 36 lb. to 50 lb. The lighter coloured woods are usually the less dense.

The dry bark contains about 10 per cent. of tannin, but is rarely used.

Acacia implexa, Benth. "Lightwood." (Plate LXXIX.)

Description.—A glabrous tree, 30 feet to 40 feet high, and up to 2 feet diameter, the branchlets terete or nearly so. Phyllodia lanceolate-falcate or acuminate, mostly 5 inches to 6 inches long with several slender longitudinal veins and fine nerves. The small dense heads of numerous white mostly five-partite flowers, are on stalks grouped in a short raceme. The turbinate calyx is scarcely half as long as the corolla, and the smooth petals are united to the middle. The pod is narrow, linear, much curved or twisted, is constricted between the seeds, and is two to three lines broad with oblong seeds. The funicle is swollen, coloured, and much folded at the base of the seed.

Habitat.—A native of the North-West, South-West, South, North-East, and East of Victoria, on open river banks and grassy ridges, mountain slopes and near the coast, scattered over the State and at Bacchus Marsh, as well as on the Yarra and Snowy Rivers. Also in New South Wales and Queensland.

The Lightwood is closely related to the Blackwood (*A. melanoxylon*), but has more twisted pods, the phyllodia are more narrowed at the base and more pointed at the tip, while the funicle does not encircle the seed.

Timber.—Usually paler than Blackwood, dense, hard, close-grained, interlocked. Useful for cabinet work, carriage timbers, bearings, blocks, &c., and stands hard wear. A cubic foot weighs 44 lb. to 50 lb.

Stock eat the leaves readily and destroy seedlings. The bark contains 8 per cent. to 15 per cent. of tannin and also a saponin which stupefies fish when the crushed bark is thrown into water.

Acacia oxycedrus, Sieb. "Spike Acacia." (Plate LXXX.)

Description.—A tall, rigid, spreading shrub 5 feet to 15 feet high. Phyllodia scattered, narrow, lanceolate, sessile, ½ inch to nearly 1 inch long, striate with three or four veins, tapering to a sharp point. Flowers

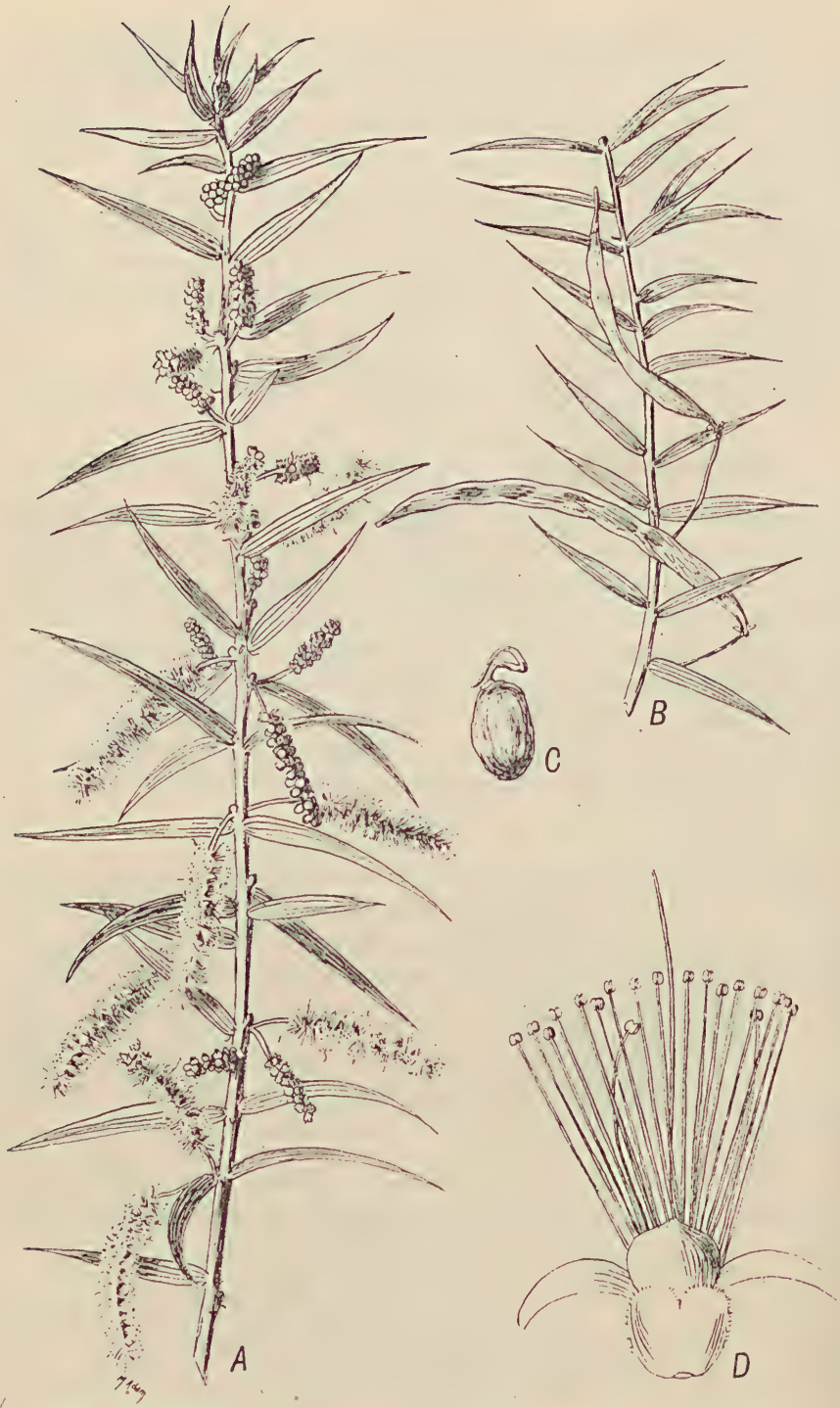


Plate LXXX.—*Acacia oxycedrus.* The Spike Acacia.

A. Branch with phyllodes and flower spikes.
B. Phyllodes and fruits.
C. Seed with bent funicle.
D. Flower, showing calyx, petals, stamens, and style.

Plate LXXXI.—*Acacia verticillata.* The Prickly Acacia.

A. Branch with phyllodes and flower spikes.
B. Flower.
C. Fruits.
D. Seed with funicle.

Plate LXXXII.—*Acacia Dallachiana.* The Catkin Acacia.

A. Flower opened.
B. Flower in bud.
C. Fruit.
D. Seed with aril.

mostly four-partite in cylindrical spikes, often more than an inch long. Calyx with short obtuse lobes ; petals smooth and spreading. Pod incurved, often above 3 inches long and about two lines broad and pointed at the tip, with oblong longitudinal seeds. Funicle folded but not forming a prominent aril.

Habitat.—A native of South-West, South, North-East, and East of Victoria, not unfrequent in heathy tracts throughout the southern part of the State and ascending into the mountains ; also in New South Wales and Tasmania.

Timber.—Too small to be of economic value.

Acacia verticillata, Willd. "Prickly Moses." (Plate LXXXI.)

Description.—A shrub of 5 feet to 8 feet sometimes growing into a small tree 15 feet to 20 feet high, with mostly whorled linear subulate to lanceolate phyllodia from $\frac{1}{2}$ inch to $\frac{3}{4}$ inch long and sharp pointed. The whitish yellow flowers are in a dense cylindrical spike of $\frac{1}{2}$ inch to 1 inch long, are four-partite and are globular when in bud. Calyx broad, bluntly lobed. Petals united at the base. Pod flat, $1\frac{1}{2}$ inches to 2 inches long and two lines broad, with oblong longitudinal seeds. Funicle folded but not forming an aril.

Habitat.—A native of South-West, South, North-East and East Victoria, abundant in all the more humid parts of the State and extending to altitudes of over 1,000 feet ; also in New South Wales, South Australia and Tasmania.

Timber.—Too small to be of economic value.

Acacia Dallachiana, F.v.M. "Catkin Acacia." (Plate LXXXII.)

Description.—A tree attaining a height of 20 feet to 30 feet, with angular, usually glaucous branchlets. The phyllodia are lanceolate, falcate, coriaceous, obtuse or with callous points, 3 inches to 6 inches long, and often an inch broad at the middle, with two to six more or less prominent nerves. Flowers mostly four-partite in long almost sessile usually paired spikes and with peltate bracts among the flower buds. Calyx obtusely toothed more than half as long as the petals. Pod linear, 2 inches to $2\frac{1}{2}$ inches broad and constricted between the ovoid longitudinal seeds. Funicle folded and forming a cup-shaped basal aril.

Habitat.—A native of North-East Victoria, between granite blocks on the summits of the Buffalo Ranges at an elevation of 4,000 to 4,500 feet. It is confined to Victoria.

Timber.—The tree is comparatively rare and no use appears to have been made of its timber.

Plate LXXXIII.—*Acacia longifolia*. The Sallow Acacia.

A. Branch with phyllodes and flower spikes.
B. Dehiscing fruit.
C. Flower.
D. Flower bud.

mucronata, var. dissitiflora

Plate LXXXIV.—*Acacia linearis*. The Narrow-leaved Acacia.

A. Branch with phyllodes and flower spikes.
B. Fruits.
C. Flower.
D. Seed.

Plate LXXXV.—*Acacia aneura.* THE MULGA.

A. Branch with phyllodes and flower spikes. Bud showing sepals and closed petals. Flower showing sepals, expanded petals, stamens, and style. Cluster of flattened fruits.

B. Seed with bent funicle.

The variety *floribunda*, sometimes recognized as a distinct species, is a taller and more tree-like variety with narrower phyllodes and usually growing on the banks of streams. The wood forms fairly good fuel, but is not otherwise much used.

Acacia longifolia, Willd. "Sallow Acacia." (Plate LXXXIII.)

Description.—An erect shrub often growing into a small tree 15 feet to 30 feet high and up to 8 inches or a foot in diameter, with angular branchlets and broadly oblong to oblong-lanceolate or linear, two to five veined, phyllodia, varying in length from 2 inches to 6 inches. Flowers usually four partite in axillary, somewhat loose, spikes. Calyx very short and toothed. Petals spreading but usually united at the base. Pod linear, often several inches long and two to four lines broad with longitudinal seeds, and usually contracted between them. Funicle forming a large cup-shaped aril at the base of the seed.

Habitat.—A native of South-West, South, North-East and East Victoria, but chiefly in the eastern parts of the State. Also in the eastern and southern coastal districts of Australia.

Timber.—Pale, light, tough, hard, useful for tool-handles, but usually too small to be of much economic value. This is essentially a coastal species and is very variable, including five or six varieties varying chiefly in the size, shape and thickness of the phyllodia, but also in the pod or even in the flower. The young shoots are eaten by stock and hence the plant is easily killed out in grazing areas. It seeds freely and usually flowers early in spring or at the end of winter.

Acacia linearis, Sims. "Narrow-leaved Acacia." (Plate LXXXIV.)

Description.—An erect shrub 5 feet to 15 feet high, with angular branchlets and glabrous or slightly pubescent when young. Phyllodia narrow-linear and from 4 inches to 6 inches long to twice that length and one line broad. Flowers pale yellow, mostly four-partite, in loose slender interrupted spikes, 1 inch to 2 inches long. Calyx very shortly toothed and small, and the petals united at their bases. Pod linear, several inches long, usually about two lines broad, with oblong longitudinal seeds.

Habitat.—A native of the South, North-East and East of Victoria, in wet forest glens and on periodically flooded river banks. Also in New South Wales, Queensland and Tasmania.

Timber.—Too small to be of economic value.

Acacia aneura, F.v.M. "Mulga." (Plate LXXXV.)

Description.—A shrub or small tree, sometimes 20 feet or even 30 feet high, with nearly or quite terete branchlets, often hairy. Phyllodia narrow linear, obtuse or with a recurved or oblique callous point, 1½

Plate LXXXVI.—*Acacia doratoxylon*. The Currawang.

A. Branch with phyllodes and flower spikes.
B. Dehiscing fruit.
C. Flower.
D. Unexpanded spike of flower buds.
E. Seed, entire and showing funicle.
F. Carpel.

inches to 3 inches long and one to one and a half lines broad without conspicuous veins. Flowers mostly five-partite in shortly stalked spikes ¼ inch to ¾ inch long. Sepals free, very narrow and linear spathulate. Petals united at the base, with blunt spreading lobes. Pod thin, flat, 1 inch to 1½ inches long and about ½ inch broad with ovate and oblique or transverse seeds. Funicle twice folded and expanded at the base of the seed into a small, thin aril.

Habitat.—A native of North-West Victoria, and along the Murray River; also in New South Wales, Queensland, South and Western Australia, and in the Northern Territory.

Timber.—Dark brown to almost black, very hard, heavy and dense. Useful for cabinet work and forms good bakers' fuel, giving an intense heat. Used by the aborigines to produce their long, narrow shields, or "mulgas." The tree usually forms a low scrub on river flats, sandy hills or even ironstone ridges. It forms a valuable fodder plant of the interior, particularly for cattle and camels. The phyllodes contain about 2 per cent. of tannin, but have a fairly high albuminoid ratio. It seeds freely but the seedlings are eaten out by stock.

Acacia doratoxylon, Cunn. "Currawang." (Plate LXXXVI.)

Description.—A tall shrub or small tree attaining a maximum height of 20 feet to 35 feet and up to 1 foot diameter. It is glabrous with an ashy hue on the branchlets, which are at first angular, but soon become more rounded and terete. The phyllodia are elongated, slightly falcate, shortly acuminate, 4 inches to 8 inches long, two, three, rarely four, lines broad with numerous fine parallel veins and a more prominent central one. The spikes are shortly pedunculate, solitary or clustered, rarely 1 inch long and rather dense. The flowers are mostly five-partite. The sinuate-toothed calyx is less than half as long as the corolla. Petals with somewhat prominent midribs. Pod narrow, nearly straight. Funicle curved, once-folded, but not forming a prominent aril. Seed oblong longitudinal.

Habitat.—A native of the North-East of Victoria, in the Ovens Ranges; also in Western Australia, South Australia, New South Wales and Queensland. It usually grows on stony ridges, and stands dry conditions well.

Timber.—Somewhat similar to "Blackwood," but usually paler, less figured, harder and denser. Dark brown with a thin layer of yellow sap-wood. Close-grained and durable. Useful for cabinet work, blocks and pulleys, bearings, carving and turnery. A cubic foot weighs 52 lb. to 60 lb.

The leaves are eaten by stock, and hence seedlings are suppressed unless fenced off. The aborigines used the wood for spear shafts.

Plate LXXXVII.—*Acacia glaucescens.* The Coast Myall.

A. Flowering branch.
B. Fruits.
C. Seed in portion of fruit valves and showing funicle.
D. Flower, enlarged.

botrycephala

Plate LXXXVIII.—*Acacia ~~discolor~~*. The Sunshine Wattle.

A. Branch with pinnate compound leaves and flower heads.
B. Fruit.
C. Flower with calyx, petals, stamens, and style.
D. Seed with funicle.

Plate LXXXIX.—*Acacia decurrens*. The Early Black Wattle.

A. Branch with compound pinnate leaves and flower heads.
B. Flower bud.
C. Flower with calyx, petals, stamens, and style.
D. Carpel.
E. Dehiscing fruits.
F. Seed with funicle.

Acacia glaucescens, Willd. "Coast Myall." (Plate LXXXVII.)

Description.—A large glaucous tree 20 feet to 50 feet in height and 1 foot to 2 feet diameter, with oblong-falcate or lanceolate phyllodia, mostly 4 inches to 6 inches long and ½ inch to 1 inch broad, with three to five prominent veins. The drooping habit of the foliage and the yellow spikes make the tree very handsome in early spring. The spikes are nearly sessile or shortly pedunculate and 1 inch to 2 inches long. The flowers are not very closely crowded, mostly five-partite, with a short truncate or sinuate-toothed calyx. Petals united to the middle and hairy. The pod is narrow-linear, nearly straight or slightly constricted between the seeds. Funicle folded and dilated at the base of the seed, but not encircling it.

Habitat.—A native of Queensland and New South Wales, but now planted and growing wild in Victoria. For the most part this is a coastal species, usually growing around the edges of rocky gullies, or on the banks of rivers.

Timber.—Dark brown to reddish brown, very hard, dense and close-grained, but usually without a prominent figure, but prettily marked and slightly scented. Seasons, works and polishes well. Useful for cabinet work, tool handles, fittings and furniture. A cubic foot weighs 60 lb. to 62 lb. when seasoned, and about 55 lb. when perfectly dry.

Acacia discolor, Willd. "Sunshine Wattle." (Plate LXXXVIII.)

Description.—A tall shrub or small tree from 10 feet to 25 feet high, with terete or angular branchlets and compound leaves of two to six pairs of pinnae, bearing ten to fifteen pairs of leaflets, oblong or acute, three to four lines long and one nerved. The flower heads are in axillary racemes forming a terminal panicle, the flowers are whitish, six to fifteen in the head, with a short calyx having blunt ciliate lobes and rather rigid erect petals. The pod is up to 3 inches long and five to six lines broad, with oblong-longitudinal seeds. Funicle short, slightly thickened at the base of the seed.

Habitat.—A native of the East of Victoria on heathy ground in the lowlands as well as in the mountains of Gippsland. Also in New South Wales and Tasmania.

Timber.—Rather too small to be of much value. The tree is not very common and the wood is rarely used.

Acacia decurrens, Willd. "Early Black Wattle." (Plate LXXXIX.)

Description.—A handsome tree attaining a height of 20 feet to 40 feet and a diameter of a foot to 1½ feet, and glabrous or more or less tomentose-pubescent. Leaves compound with five to ten pairs of pinnae, rarely only four to six, bearing 20 to 30 pairs of small leaflets, linear and from

Plate XC.—*Acacia mollissima.* The Black Wattle.

A. Branch with flower heads and three large compound leaves.
B. Flower with calyx, petals, stamens, and style.
C. Carpel.
D. Fruit.
E. Seed with aril.

four lines to five lines long. The flower heads are small and globular in axillary racemes. They appear early in the season. There are 20 to 30 flowers in each head, mostly five-partite, with a short, almost truncate calyx or with blunt ciliate lobes. Petals almost keeled, lobes free. The pod is 3 inches to 4 inches long by $\frac{1}{4}$ inch broad and with oblong-ovate seeds. Funicle short, folded, forming an arillar swelling at the base of the seed.

Habitat.—A native of South-West, South, North-East, and East of Victoria, frequent along river banks or in valleys and ascending to subalpine elevations. Also in New South Wales and Queensland.

Timber.—Of very rapid growth and hence with a broad layer of sapwood, darkening centrally in old trees to brown or reddish brown. Straight and free-grained, but hard and tough. It may attain a height of 30 feet and a diameter of 8 inches in five years. A cubic foot weighs 46 lb. to 50 lb. when seasoned. Can be used for poles when grown in close plantations and owing to its rapid growth often planted for fuel (South Africa), for shelter or for its bark (tannin). The tree is very liable to the attacks of borers and near towns rarely lasts longer than ten or fifteen years. If, however, then cut back hard, it will often start fresh vigorous growth. The dry bark contains over 30 per cent. of tannin. The gum exuding from wounds resembles gum arabic and is of bacterial origin.

Acacia mollissima, Willd. "Black Wattle." (Plate XC.)

Description.—Usually a small tree 20 feet to 30 feet, but sometimes taller resembling the Early Black Wattle, but flowering late in the season and with softly tomentose foliage, greyish when old. The pods are flat, rather broad, hardly constricted between the seeds, and the flowers are whitish yellow and very sweet-scented. It differs also from the preceding species in the more numerous pinnae, shorter pinnules, more distinct lobes to the calyx, and usually shorter pods.

Habitat.—A native of the South-West, South, North-East and East of Victoria, frequent along river banks, in valleys or gullies, more rarely in open, exposed spaces. Also in Queensland, New South Wales, South Australia and Tasmania.

Timber.—Light, tough and strong, but of little use except for firewood. The Yarra blacks used it for shields, boomerangs and spears. A cubic foot weighs 50 lb.

Bark.—Valuable for tanning. The dry bark contains 30 per cent. to 36 per cent. of tannin. A variety, *pauciglandulosa*, is sometimes distinguished as having fewer glands on the leaf-stalks and stalklets, but the number of glands is a variable feature. Some Queensland and New South Wales forms have long weak hairs on the leaf-stalks (var. *Leichhardtii*).

Plate XCI.—*Acacia dealbata.* The Silver Wattle.

A. Branch with compound leaves and flower heads.
B. Fruits, one dehiscing.
C. Flower with calyx, petals, stamens, and style.
D. Seed.
E. Portion of compound leaf showing leaflets.

Acacia dealbata, Link. "Silver Wattle." (Plate XCI.)

Description.—A handsome tree 30 to as much as 80 or more feet high, and 1 foot to 2 feet in diameter, with whitish-yellow heads of flowers appearing early in spring. Leaves compound with ten to twenty pairs of pinnae bearing 30 to 40 pairs of leaflets, linear, crowded and two lines to three lines long. Leaf glands usually numerous and the foliage silvery at a distance. Flower heads small in axillary racemes, paniculate at the ends of the branches. Flowers sweet-scented. Pod broad, rather flat and hardly constricted between the seeds. Funicle short, folded, not forming a prominent aril.

Habitat.—A native of South-West, South, North-East and East Victoria, mostly on river banks or in valleys; also in the southern and eastern districts of Australia. Much grown on the Riviera of Southern Europe and sold in England as "Mimosa."

Timber.—Pale, moderately hard, but tough, darkening at the centre to light brown or dark brown. Sometimes used for boxes and cooperage (cask staves). It has been used for furniture and shows a good grain when polished. It is of rapid growth (30 feet in five years, 45 feet in eleven years) and attaining a greater age and larger size than the two preceding species, the maximum height being 90 feet with a diameter of 3 feet (Tasmania).

Bark.—Sometimes used for tanning, but of inferior quality, and rarely containing more than 20 per cent. to 25 per cent. of tannin. A cubic foot when seasoned averages 48 lb. to 50 lb.

Bentham regards *Acacia mollissima* as a variety of *A. decurrens* and Mr. Maiden (*Forest Flora*, p. 40) also reduces *A. dealbata* to a variety of the same species. This is largely a matter of personal judgment and it is certainly more convenient to regard them as three distinct species. The typical forms of each are easily separated, both in the herbarium and in the field, particularly in the case of the Silver Wattle. *A. decurrens* flowers early (June-September), and *A. mollissima* late in the season (September-March), at least in Victoria, and the existence of connecting links between species may indicate either that the species are of recent origin or that they readily hybridize. They may be distinguished as follows:—

1. Flowering early	Three and four.
2. Flowering late	*A. mollissima.*
3. Foliage green	*A. decurrens.*
4. Foliage silvery	*A. dealbata.*

PAPILIONATAE.

Herbs or shrubs, rarely trees, with palmate or pinnate stipulate leaves and usually fairly large and brightly coloured flowers, zygomorphic and more or less butterfly-shaped. Sepals, five, usually united to form a

Plate XCII.—*Viminaria ~~denudata.~~ juncea* The Golden Spray.

A. Flowering shoot.
B. Branch with fruits.
C. Fruit.
D. Fruiting calyx.

five-toothed or lobed calyx, the two upper and three lower often forming a bilabiate calyx. Petals five, a larger posterior one, the standard; two lateral ones, the alae; the front pair fused anteriorly to form the carina. Rarely only the standard is present. Stamens inserted within the base of the petals, usually ten, nine united basally and one free, or all united, or all free, or rarely five only. Carpel single, ovary superior. Fruit a legume, sometimes splitting into one-seeded pieces, or indehiscent (some Sophoras) or one-seeded (Clovers). Seeds one to many, usually with little or no endosperm.

The order includes about 450 genera and 7,000 species and is represented in all parts of the globe, except the extreme north and south, and form a characteristic feature of the flora of most temperate regions. Few Australian forms attain tree-like dimensions.

PAPILIONATAE—PODALYRIAE.

The sub-group is well represented in Australia and includes the *Dillwynias, Jacksonias, Daviesias, Podalyrias, and Pultenaeas.* A few are poisonous, such as *Gastrolobium* and possibly *Gompholobium.* The majority are small shrubs, forming a fairly large proportion of the undergrowth in forests or around the borders of forest land. Very few do well in strong shade, most being light-loving plants. Only one Victorian species needs special mention.

Viminaria denudata, Smith. "Golden Spray." (Plate XCII.)

Description.—A glabrous shrub with wiry pendulous branches, having the leaves reduced to filiform petioles, 3 inches to 8 inches or even 9 inches long, rarely bearing a few leaflets. Flowers in long terminal racemes, yellow or orange yellow, small on short stalks rarely as long as the truncate, but shortly-toothed calyx, which is 2 lines in length. Corolla about four lines long. Small, seed-like, one-seeded pod, two to three lines long. Stamens rarely fewer, all free.

Habitat.—Usually a small shrub, spread over the whole of the southern half of Australia, and in Victoria growing in the South-West, South, and North-East and Eastern Districts.

Timber.—It may, however, attain a height of 10 feet to 20 feet and then yields a little wood which can be used for cabinet work or turnery.

Seeds give good germination up to fifteen years and the hard seeds in a sample may be germinated up to 25 years.

PAPILIONATAE—GENISTAE.

Although this group includes a number of tall shrubs or trees such as *Genista, Cytisus and Laburnum,* only one Victorian species occasionally attains the dimensions of a tall shrub.

Plate XCIII.—*Goodia lotifolia*. The Golden Tip.

A. Branch with leaves and flowers.
B. Seed with aril.
C. Fruits.

Goodia lotifolia, Salisb. "Golden Tip." (Plate XCIII.)

Description.—A tall, much-branched shrub, glabrous or pubescent. Leaves compound with ovate or obovate, obtuse leaflets, ½ inch to ¾ inch long, resembling the leaflets of Trefoil. Flowers stalked in loose, several-flowered racemes, 2 inches to 4 inches long. Calyx two and a half to three lines long and about half the length of the standard, which is yellow with a purple base. Upper lobe of calyx broad and notched, the three lower lobes long and narrow. Stamens ten, rarely fewer, all united into a sheath, split on the upper side. Pod usually rhomboid-elliptical and from ½ inch to 1 inch long, on a long slender stalk; seeds with a lateral aril.

Habitat.—It is generally distributed over Victoria (S.W., S., N.E., and E.), around Port Phillip Bay and from Gippsland to the Glenelg; and under favorable conditions it attains a height of 10 feet to 15 feet. It has been frequently suspected of being poisonous to stock, but the evidence is unsatisfactory and its timber value is practically negligible. It is, however, a useful undergrowth in open forests, keeping the soil open and porous and enriching it with nitrogen. The seeds give good germination up to 50 years, particularly if the sample contains a large percentage of hard seeds requiring treatment with strong sulphuric acid before they swell. In one sample 105 years old 7.7 per cent. germinated.

EUPHORBIACEAE.

This is a large order of varied habit and floral structure. It is widely spread in both temperate and tropical regions and includes both moisture-loving and desert plants. Some species of *Euphorbia* are of xerophytic habit and bear an external resemblance to *Cacti*. Most are trees, but a few are shrubs or even small herbs. Among the trees some of the best rubber trees are included (*Hevea*, *Manihot*), but these are tropical only, and the occurrence of milk tubes containing latex is very common throughout the order. Many genera are poisonous or contain poisonous species (*Phyllanthus*, *Croton*, *Euphorbia*, *Ricinus*). The flowers are either male and female, as in the Castor Oil, or the male and female flowers are clustered in little inflorescences surrounded by bracts or glands, or by a cup-like involucre, and resembling single flowers (*Euphorbia*).

Flowers unisexual. Calyx small or absent. Petals when present usually free. Stamens equal or double the petals, or numerous, or reduced to one. Female flowers often with staminodia. Ovary usually three-chambered, rarely more or only one, each chamber with one or two ovules. Fruit usually splitting into three one-seeded cocci, rarely drupaceous or berry-like.

The order includes about 210 genera and 4,000 species, of which 700 belong to *Euphorbia*, 600 to *Croton* and 400 to *Phyllanthus*. It is not strongly represented in Australia by native plants and in Victoria very few forms attain a shrubby or almost tree-like character.

Plate XCIV.—*Claoxylon australe.* The Brittlewood.

Flowering branch.

1. Male flower.
2. Female flower.
3. Fruit.
4. Seed.

Plate XCV.—*Adriana quadripartita.* The Common Bitter-bush.

A. Branch with carpellary flowers and fruit.
B. Branch with staminate flowers.
C. Staminate flower.
D. Carpellary flower.
E. Fruit.
F. Transverse section of fruit.

Plate XCVI.—*Omalanthus Leschenaultianus.* The Poplar Spurge.

1. Male flowers and bracts.
2. Male flowers spread open to show stamens.
3. Young stamen.
4. Old stamen.
5. Female flower, with style and stigma.
6. Section of capsule.

Homalanthus populneus

Claoxylon australe, Baillon. "Brittlewood." (Plate XCIV.)

Description.—A tall shrub or straggling tree sometimes attaining a height of 25 feet to 30 feet, with oblong, broad or narrow, more rarely ovate, stalked leaves, 3 inches to 6 inches long. Flowers unisexual, the male racemes 2 inches to 3 inches long, the females much shorter. Young male flowers nearly globular, on short pedicels, the perianth splitting into three segments, about a line long. Stamens usually about 20, mixed with ovate glands, and about as long as the perianth. Perianth of the female flowers rather thicker and less deeply divided; ovary three-celled, each cell with one seed, more or less pubescent, styles short but free.

Habitat.—Although this genus has a wide geographic range, from Africa to the islands of the Pacific and in the Old World tropics, it is poorly represented in Australia, and its only tree-like representative in Victoria has but little timber value and is really a native of New South Wales which has been planted in Victoria.

Adriana quadripartita, Gaud. "Common Bitter Bush." (Plate XCV.)

Description.—A shrub growing up to a height of 10 feet or 15 feet, with opposite sessile or very shortly stalked, ovate, ovate-lanceolate or oblong leaves, mostly 1 inch to 2 inches, rarely 3 inches long. Flowers unisexual in short, few-flowered spikelets. Male perianth four to five partite, stamens indefinite with short filaments and the connective prolonged beyond the anther. Female flowers with a double perianth of six to eight parts. Ovary three-chambered; styles united at the base. Capsule splitting into valves with smooth oval or egg-shaped seeds.

Habitat.—This small genus of five species is restricted to Australia and its representative in Victoria is too small to have any value as a timber tree. It grows around Port Phillip, Cape Otway and in Gippsland (S.W., S. and S. E. Victoria).

Timber.—It can be used for walking sticks and small turnery, but is not specially useful for timber.

Omalanthus Leschenaultianus, Jussieu. "Poplar Spurge." (Plate XCVI.)

Description.—A tall shrub or small tree, sometimes attaining a height of 20 feet to 25 feet. Leaves glabrous, broadly ovate-triangular or acuminate, thin, 2 inches to 4 inches or even 6 inches long and often as broad, on petioles usually about the same length. Flowers unisexual in racemes, 1 inch to 4 inches long. Male flowers three to six together on short stalks with a short perianth, splitting into two broad segments. Usually about six stamens to each flower. Female flower usually on a curved stalk the base of the ovary enclosed by the short perianth. Capsule smooth, four to five lines broad. Seeds held enveloped in a fleshly aril and apparently soon losing the power of germination when dried.

Plate XCVII.—*Beyeria viscosa*. The Sticky Wallaby Bush.

Branch with male and female flowers.

1. Male flower.
2. The same, open.
3. Young, and
4 and 5. Older female flowers, with ovary projecting.
6. Fruit of three cocci.
7. The same in section.
8. Coccus of fruit separated and dehiscing.

Habitat.—The genus of eight species extends from the Malay Archipelago to Australia and the Pacific Islands. Owing to its handsome foliage it is often grown in gardens, the favourite species being *O. populneus*. Our species is really a native of New South Wales, but it has been planted in Gippsland and in the East of Victoria.

Timber.—It can be used for turnery and small cabinet work.

Beyeria viscosa, Miquel. "Sticky Wallaby Bush." (Plate XCVII.)

Description.—A tall shrub or small tree occasionally reaching a height of 15 feet to 20 feet and a diameter of a foot, with oval-oblong to oblong-lanceolate leaves tapering into a petiole. Flowers unisexual, axillary or lateral on recurved stalks of $\frac{1}{4}$ inch to $\frac{1}{2}$ inch in length. The males often two to three together, the females solitary. Perianth segments broad, coloured, about two lines long and thicker in the female flowers. Stamens clustered, indefinite, the anthers about twice as long as broad, closely attached to the narrow connective. Ovary nearly globular with a short style and a broad, closely-appressed stigma. The seeds apparently soon lose the power of germination if kept for more than a year.

Habitat.—The thirteen species of the genus *Beyeria* are restricted to Australia. *B. viscosa* occurs in Western Australia as well as in South Australia, Victoria and Tasmania. In Victoria it is found at Port Fairy, Cape Otway, Murray River and Gippsland (S.W., S., N.E., and E. Victoria).

Timber.—Too small to be of much use. Pinkish in colour. A cubic foot when air dry weighs 46 lb. to 47 lb.

Bertya Findlayi, F.v.M. "Mountain Bertya." (Plate XCVIII.)

Description.—A tall shrub or small tree, rarely 15 feet or 20 feet high, with linear-oblong flat leaves 1 inch to 3 inches long. The flowers are sessile or nearly so, with small bracts and a larger petaloid perianth. The male flower has five perianth segments and the stamens united to a central column. The ovary projects beyond the smaller, narrower perianth segments of the female flower and forms an ovoid capsule usually one-celled and one-seeded. Seed with an aril.

Habitat.—The twelve species of the genus are confined to the South-East of Australia; *B. Findlayi* is restricted to the North-East of Victoria.

Timber.—Too small to be of economic value.

CELASTRACEAE.

A small but widely-distributed order including 35 genera and nearly 400 species with entire, opposite or alternate leaves, including a few woody climbers. Flowers radial, usually hermaphrodite. Calyx small,

Plate XCVIII.—*Bertya Findlayi.* The Mountain Bertya.
Flowering branch.
1. Female flower. 2. Seed with aril.

inferior with four to five free lobes. Petals four to five, rarely none, free or slightly united at the base. A disc usually present. Stamens four to five alternating with the petals, rarely ten. Ovary superior, two to five chambered, rarely one-chambered. Style short, stigma usually capitate or small, rarely lobed. Ovules two in each chamber, rarely more or less. Fruit one to five chambered, one to several seeded, usually a loculicidal capsule, or if one or two seeded, a winged fruit or a berry or drupe. Seeds usually with a red aril.

Many of the 60 species of *Euonymus* yield a wood much prized for wood-carving and cabinet work, but the order does not contain any important timber-producing trees. Only one Victorian representative is worthy of mention.

Celastrus australis Harvey. "Staff Climber." (Plate XCIX.)

Description.—A woody climber attaining a height of 15 feet to 20 feet, with ovate to lanceolate, entire or somewhat serrulate leaves, two to four inches long, narrowed to a short petiole. The leaves are deciduous. Flowers usually in short loose terminal panicles. Calyx ciliate, bluntly lobed. Petals five, yellowish-white, broadly ovate. Stamens five, inserted on the margin of the disc. Ovary three-celled, forming a nearly globular capsule, about three lines diameter, reddish-yellow. Style with three diverging stigmatic lobes. Seed with a large orange-yellow aril.

Habitat.—The genus *Celastrus* contains about 30 species mainly extending from China to Australia. *C. australis* occurs in moist forests along the Snowy and Buchan Rivers and in the North-East and East of Victoria.

Timber.—The stems are too small to have a great timber value, but can be used for walking sticks as well as for cabinet and fancy work. The wood is tough, fairly hard and light yellow. A cubic foot weighs 45 lb. to 48 lb. when seasoned. It polishes well and somewhat resembles Box.

SAPINDACEAE.

A fairly large order of 120 genera and about 1,000 species of tropical trees, but including a few woody twining climbers (*Lianas*), some tendril climbers, and a few temperate shrubs or small trees. The timber is usually hard, and especially so in *Quebracho* (Axe-breaker), often dark-coloured, and, particularly in lianas, it is often subdivided into regular or irregular segments looking like fused branches. The fruits are often edible (Litchi, Senegal Cherry, Rambutan, Honey Berry, Native Tamarind) or medicinal

Plate XCIX.—*Celastrus australis.* The Staff Climber.

1. Side view unexpanded flower.
2. Side view expanded flower.
3. Flower seen from above.
4. Disc opened out, with stamens and ovary.
5. Side view of fruit.
6. Fruit from above.
7. Abnormal two-valved fruit.
8. Seed.
9. Longitudinal section of seed.

Alectryon subcinereus

Plate C.—*Nephelium leiocarpum.* THE SMOOTH RAMBUTAN.

1 and 2. Flower.

3. Fruit.

4. Fertile lobe of fruit opened.

(Hopbush). In some forms with edible fruits, the seeds are poisonous (Senegal Cherry), and many species are used as fish poisons (*Sapindus, Paullinia, Serjania*). Saponin is widely present and a few species yield dyes.

Flowers usually inconspicuous, male and female, each with the other organs present but infertile or rudimentary, both usually on the same plant, but on different plants in *Dodonaea*. Calyx inferior usually of five free sepals, sometimes two fused. Petals usually five, sometimes four, or rarely small or absent. Disc present. Stamens in two rows of five, reduced by abortion to eight, seven, or six, or to a single row of five or four, or rarely numerous. Ovary usually of three carpels, rarely four or two, and three, four or two-chambered, or lobed. Ovules usually one or two to each chamber, rarely numerous. Fruit a capsule, nut, berry or drupe, or splitting into segments often winged. Seeds without endosperm.

Three genera are represented by trees or tall shrubs in Victoria.

Each loculus of ovary with two ovules. Petals absent.

Fruit capsular, developing winged outgrowths usually red—*Dodonaea*.

Each loculus of the ovary with one ovule.

Fruit indehiscent, petals usually present—*Nephelium*.

Fruit a loculicidal capsule, petals absent—*Heterodendron*.

NEPHELIUM (ALECTRYON).

A genus of 50 species mainly in the Indian Archipelago and China, and including the Chinese Litchi which is sometimes considered to be a distinct genus; also extending to Australia and Papua. Stamens six to eight, fruit usually lobed, often deeply so. The seeds appear to be of short duration not remaining viable beyond a year or two.

Nephelium leiocarpum F.v.M. "Smooth Rambutan." (Plate C.)

Description.—A tree attaining a height of 20 feet to 30 feet, with glabrous leaves of two to six oblong-elliptical, ovate-lanceolate or lanceolate, pointed or obtuse leaflets 3 inches to 4 inches or even 5 inches long. Flowers in loose panicles. Calyx small with broad lobes, the petals broad and short but variable (four to six), the scale on the petal nearly as long as the petal itself. Stamens six to eight, with oblong anthers, glabrous or nearly so. Fruit nearly or quite sessile, with distinct globular lobes, four to five lines in diameter, with a leathery shell enclosing a seed surrounded by a fleshy aril. In the tropical Rambutan (*N. lappaceum*) the wall of the fruit is prickly and the edible aril more strongly developed.

Habitat.—The smooth Rambutan is scarce in Victoria, occurring only in Gippsland and the East of Victoria. Also in New South Wales and Queensland, where it becomes a tall tree.

Plate CI.—*Heterodendron oleaefolium.* The Olive Rose-wood.

1. Flowering branch.
2. Fruiting branch.
3. Young flower.
4. Flower more advanced.
5. Part of flower.
6. Vertical section of flower, stamens removed.
7. Stamens.
8. Fruit.
9. Seed.

Timber.—Pale brown, fairly hard, with a close even grain, without any pronounced figure. A cubic foot weighs 50 lb. to 52 lb. Useful for tool handles and for constructional work when obtainable in sufficient size.

HETERODENDRON.

Heterodendron oleaefolium Desfont. "The Olive Rose Wood," or "Cattle-bush" (Plate CI.)

Description.—A tall shrub attaining a height of 10 feet, rarely 20 feet, with a girth of 15 inches to 20 inches, the young shoots often hoary with a minute pubescence; leaves simple, entire, narrow linear-lanceolate or narrow oblong, rarely almost obovate, acute or obtuse, 2 inches to 4 inches long on short petioles and somewhat greyish-green in colour. Calyx broad, cup-shaped, varying from one and a half to three lines diameter, shortly and irregularly toothed. Petals absent. Stamens six to fifteen. Ovary usually three or four celled, densely tomentose. Fruit with one or two, very rarely three or four, globular lobes three to four lines diameter. Seeds with a red, fleshy aril.

Habitat.—A xerophytic shrub found in North-Western Victoria (Mallee Scrub, Murray, Wimmera, and Avoca Rivers). It is widely spread in all the States of Australia, growing to a moderate-sized tree up to 30 feet, in warm, fairly moist districts. The foliage is eaten by sheep and cattle, but it is a second-grade fodder, and air-dried leaves contain about 4 per cent. of tannin.

Timber.—Sap-wood pale, heart-wood dark brown to almost black, Very hard with a close, straight grain. A cubic foot weighs up to or over 70 lb. Useful for engraving, carving, handles of small tools, rollers and rolling-pins.

DODONAEA.

Of this genus of shrubs and trees out of 50 species all but two are Australian. It is characterized by its unisexual flowers (rarely hermaphrodite) without petals and angular-chambered fruits with a projecting angle or wing to each chamber. From the shape of the fruit and the presence of glandular resinous hairs arises the name Hopbush. In most species the leaves are pinnate; of the thirteen Victorian species, only one is worth special mention, viz., *D. viscosa*. The next largest species is *Dodonaea triquetra* Wendl., "The Large-leaved Hopbush." This is an erect, usually tall glabrous shrub, rarely attaining a height of 15 feet to 20 feet, with oval-elliptical to oblong-lanceolate leaves. Flowers on slender pedicels in short oblong, compact panicles or racemes. Sepals minute. Stamens usually eight, sometimes fewer, rarely ten, anthers linear and long, filaments short. Ovary with long styles. Fruit three-celled, and three-angled. Seeds shining but not hard or cuticularized.

Plate CII.—*Dodonaea viscosa.* The Giant Hopbush.

A. Branch with leaves and winged fruits.
B. Seed.
C. Male flower.
D. Female flower.

They often last five to ten years. A sample of *Dodonaea viscosa* gave 24 per cent. germination when seventeen years old. *D. triquetra* is of limited range in the East of Victoria, and grows on barren declivities and the granite rocks of Genoa Peak and in the vicinity of the Genoa River.

Dodonaea viscosa L. "Giant Hopbush." (Plate CII.)

Description.—A shrub, sometimes low and stunted, more frequently tall and sometimes attaining a diameter of 6 inches or so and a height of 15 feet to 30 feet, with a thin reddish-brown bark. Leaves simple acute or acuminate, 2 inches to 4 inches long and varying from broadly oblong-lanceolate to narrow-lanceolate or oblong-cuneate, always narrowed into a more or less distinct petiole. Flowers in racemes or panicles usually short and terminal but sometimes reduced to axillary clusters. Sepals five, ovate and about as long as the obtuse anthers of the male flowers. Female flowers on short stalks. Style usually short. Fruit two or three celled and angled. Seeds dull. Stigmas two.

Habitat.—A very polymorphic species spread over the whole of the Tropics, and widely and generally distributed in Victoria, usually on rocky, stony or sandy soil or in scrub land.

Timber.—When large enough the wood, which is hard, dense, heavy, tough and resistant, can be used for wedges, rammers or hedge-stakes. It can also be used for turnery, wood-carving, inlaying and cabinet work. The heart-wood is dark or almost black, variegated with light streaks and patches. It has been used for machine bearings and was used by the aborigines in Australia and New Zealand for making clubs.

RHAMNACEAE.

A small but widely distributed order of 46 genera and about 500 species almost wholly of trees and shrubs, often thorny and sometimes climbing, the leaves always simple and the flowers usually small.

Flowers always regular, and usually hermaphrodite with five, more rarely four, sepals, petals and stamens, the petals sometimes absent and usually small when present. Stamens always alternating with the sepals. Thalamus cup-shaped, sometimes fused with the ovary, three, two, or one chambered, rarely four, with one, rarely two, ovules in each chamber. Fruit dry, usually splitting into as many one-seeded pieces as there are loculi. Seeds with a large embryo and a little starchless endosperm or none at all. It has been united to other orders but it is distinguished from *Vitaceae* by the presence of small petals, from the *Celastraceae* by its epipetalous stamens, and from the *Oliniaceae* by having two or three axile seeds to each fruit-chamber instead of a single basal ovule. The genera which mainly represent the order in Australia (*Pomaderris*, *Trymalium*, *Spyridium*, *Cryptandra*) are confined to Australia, with the

Plate CIII.—*Pomaderris elliptica*. The Oval Pomaderris.

A. Branch with leaves and inflorescence.

B. Flower from above (enlarged).

Plate CIV.—*Pomaderris apetala.* The Hazel Pomaderris.

A. Flowering shoot.
B. Longitudinal section of flower (enlarged).
C. Flower from side with stamens separated (enlarged).
D. Stamen (enlarged).

exception of a few species which extend to New Zealand. Although the order contains many trees, but few yield timber of pronounced economic value. The wood of the Anchor plant (*Colletia*) contains an emetic, and the alcoholic tincture is used for intermittent fever.

POMADERRIS.

The section of the order to which this genus belongs is characterized by stellate hairs, dry fruits with a thin epicarp and an endocarp splitting into three cocci, and alternate leaves. *Pomaderris* itself has usually the flowers hairy outside, with five calyx segments and sometimes either the petals or the petals and stamens, absent, and when present, the stamens not enclosed by the petals. The style usually has three, rarely two, segments, the flowers are stalked and the bracts fall early. The genus is represented by about 20 species in the southern half of Australia, of which two also occur in New Zealand. The seeds are of limited duration, rarely remaining germinable for more than a year or two.

multiflora

Pomaderris elliptica Labill. "Oval Pomaderris." (Plate CIII.)

Description.—A tall shrub or small tree sometimes growing to a height of 20 feet or even 50 feet. Leaves 2 inches to 3 inches long and $\frac{3}{4}$ inch to $1\frac{1}{4}$ inches broad. Flowers in numerous small cymes arranged in dichotomous panicles. Calyx one to one and a half lines long with five lobes. Petals concave or nearly flat, not enclosing the anthers, and sometimes absent. Stamens five. Ovary with short style branches and capitate stigmas. Capsules about one and a half lines diameter.

Habitat.—A native of South-West, South, North-East and East of Victoria.

Timber.—Usually too small to be of economic value.

Pomaderris apetala Labill. "Hazel Pomaderris." (Plate CIV.)

Description.—A tall shrub of 10 feet to 15 feet, occasionally growing to a small tree up to 30 feet or 40 feet in height and a foot in diameter. Leaves 2 inches to 4 inches long. Flowers small and very numerous in loose panicles. Buds ovoid or nearly globular. Calyx one and a quarter lines long. Petals absent. Stamens five, anthers tipped by small glands. Styles united at least half-way up, with spreading trifid stigmas. Capsule obtuse, and bearing a few stellate hairs.

Habitat.—A widely spread plant extending from the shores of Port Phillip over the southern and eastern districts of Victoria (S.W., S., N.E., and E.)

Timber.—Often grown in gardens as an ornamental shrub, but the timber is too small to be of economic value, except in cabinet work. A cubic foot weighs 46 lb. when seasoned.

Plate CV.—*Pomaderris racemosa subrepanda.* The Wrinkled Pomaderris.

A. Branch with leaves and flowers.
B. Flower (enlarged).

Plate CVI.—*Pomaderris betulina.* The Birch Pomaderris.

A. Flowering branch and leaves.
B. Flower (enlarged).

Pomaderris subrepanda Reiss. "Wrinkled Pomaderris." (Plate CV.)

Description.—A shrub occasionally becoming almost tree-like, then attaining a height of 15 feet to 20 feet. Leaves ½ inch to 1 inch long, the lamina depressed along the main veins giving a wrinkled surface.

Flowers in small cymes, sometimes of only one or two flowers. Buds globular. Petals absent. Stamens five, Ovary very hairy, with short styles and almost capitate stigmas. Capsule ovoid, scarcely 1 inch long.

Habitat.—A native of the South and North-West of Victoria, growing along the Yarra and Forest Creek.

Timber.—Too small to be of economic value.

Pomaderris betulina, Cunn. "Birch Pomaderris." (Plate CVI.)

Description.—A slender shrub, or a small tree attaining a height of 15 feet to 25 feet. Leaves more than an inch long. Flowers in dense globular heads on short axillary peduncles or nearly sessile. Calyx about one line long. Petals absent. Stamens five, styles three, united at the base. Ripe ovaries opening by slits.

Habitat.—This plant is of limited range, being confined to East of Victoria, and growing in such localities as gravelly or rocky banks of the Genoa River. It is worthy of garden cultivation as a foliage shrub.

Timber.—Too small to be of much economic value but useful for walking sticks and small purposes.

ELAEOCARPEAE.

A very small order of seven genera and about 120 species related to the *Tiliaceae*, but never possessing the lysigenetic mucilage canals of the Lime family. It is mainly a tropical order, but the largest and most widely distributed genus *Elaeocarpus* extends to the temperate zones of the Southern Hemisphere and is represented in Victoria by two small trees. The seeds seem to lose the power of germination within a year or two when dried.

ELAEOCARPUS.

A genus of 60 species spreading from further India through the Malay Archipelago to Australia and New Zealand and through the Philippine Islands to Japan. They are all trees usually with alternate entire or serrated leaves, and the flowers in simple axillary many flowered racemes. The fruit is a stone fruit of three to five chambers with one to five seeds. The stony kernels of the larger fruited species are sometimes used for carving and turnery (*E. sphaericus*, &c.) or for armlets (*E. tuberculatus*, the seeds of which are rich in oil).

Plate CVII.—*Elaeocarpus cyaneus.* The Blue Olive Berry.

1. T.S. fruit.
2. Stamen.
3. Gynaeceum to show glandular disc and attachment of stamen.
4. Flower.

Plate CVIII.—*Elaeocarpus holopetalus.* The Black Olive Berry.

1. Single flower.
2. Gynaeceum, showing nectary and insertion of stamens.
3. Sepal and petal.
4. Stamen (dehiscing)

Elaeocarpus cyaneus Ait. "Blue Oliveberry." (Plate CVII.)

Description.—A tree usually small but sometimes attaining a height of 40 feet to 50 feet. Leaves elliptical-oblong or oblong, 3 inches to 4 inches long. Flowers in loose racemes shorter than the leaves. Sepals acute, three to four lines long, glabrous. Petals as long or rather longer, divided into ten to twelve acute lobes, in places united in pairs. Stamens numerous, within the undulate glandular disc. Anthers linear, the upper valve with a short point. Ovary glabrous two-celled with eight to ten ovules in each cell. Drupe globular ovoid, blue, 4 ~~inches~~ to 6 ~~inches~~ lines long.

Habitat.—A native of East of Victoria, in forest gullies of Wilson's Promontory and wooded ranges from the Tambo River to the eastern boundary of the State.

Timber.—Pale, close grained, with fine medullary rays and without a pronounced figure, fairly hard. Could be used in cabinet work and joinery, for door frames, panelling, &c., as well as for turnery and fret-saw work.

Elaeocarpus holopetalus F.v.M. "Black Oliveberry." (Plate CVIII.)

Description.—A tree sometimes growing to a height of 40 feet to 50 feet. The leaves on very short petioles, oblong-lanceolate, acute or acuminate, 2 inches to 4 inches long. Young shoots rusty-tomentose or villous. Racemes few flowered. Sepals 2 inches to 2½ lines long. Petals entire or slightly crenulate about three lines long. Stamens fifteen to twenty within a prominent almost cup-shaped disc. Anthers pubescent, short, obtuse. Ovary two-celled. Fruit a sub-ovoid black drupe.

Habitat.—A native of Eastern Gippsland, usually at elevations of 2,000 feet or more.

Timber.—Similar to the above but usually harder and of slower growth. At high elevations it is usually quite dwarfed.

MALVACEAE.

A small order mainly of shrubs, but also including many herbs and a few trees. It is most abundant in the Tropics, but extends to 65° North in Russia and Sweden (*Malva rotundifolia*) and to 45° south in New Zealand (*Plagianthus* sp.), mostly at low elevations, but a few forms become alpine. The flower often has an epicalyx, the petals are usually prominent and brightly coloured, stamens five or more, usually numerous and more or less united in one or two rings around the ovary, which is divided into five to many chambers each with one or more seeds. Fruit

Gynatrix pulchella

Plate CIX.—*Plagianthus pulchellus*. The Hemp Bush.

A. Flowering branch with male flowers.
B. Male flower with one petal removed.
C. Portion of stamens of male flower.
D. Back view of male flower (enlarged).
E. Persistent calyx and small staminal tube of female flower.
F. Branch with fruits.

a capsule or splitting into separate cocci. The stem usually has well developed bundles of hard bast which yield valuable fibre (*Hibiscus, Abutilon, Sida, Urena*), while the pappus from the capsule of the cotton plant (*Gossypium*) yields cotton. The seeds of certain Malvaceae (*Hibiscus Trionum, Lavatera arborea, Gossypium Sturtii*, &c.) may retain the power of germination for 20 to 50 years. but those of the only two Victorian representatives of the order which attain any large size appear to have an extreme duration of two to five years.

Gynatrix pulchella (Willd.) Alef. 1862.

Plagianthus pulchellus A. Gray. "Hemp Bush." (Plate CIX.)

Description.—The genus *Plagianthus* is confined to Australia and New Zealand and can be recognized by the absence of the epicalyx, by the single seeds in each fruit segment, and by the stigmas being on the inner sides of the styles. The fruit is like that of a Mallow, but usually with fewer chambers. *P. pulchellus* is a native of New South Wales, Victoria, and Tasmania and the fibrous bark can be used for tying or for coarse string. It is a tall shrub or small tree growing to a height of 15 feet to 30 feet.

Flowers small greenish clustered along the rachis of axillary racemes Calyx with five teeth. Petals five, free, about three lines long. Stamens about 30, anthers small and green. Filaments united basally to form a sheathing column. Ovary five-celled. In some of the flowers the ovaries do not develop fruits, the flowers being functionally male. These flowers are distinctly stalked, whereas the fruiting flowers are nearly sessile.

Habitat.—A native of South-Western, Southern, North-Eastern and Eastern Victoria, usually growing near rivers or in valleys.

Timber.—Too small to be of economic value.

Howittia trilocularis F.v.M. "Shrub Mallow," or "Blue Howittia." (Plate CX.)

Description.—Howittia is a genus of one species confined to Australia, resembling *Plagianthus* in the absence of an epicalyx, but having violet petals, only three carpels each with two seeds, and the fruit splitting into three valves with the partition walls attached. *H. trilocularis* is a tall erect shrub growing to a height of 10 feet to 20 feet with long weak branches covered with stellate hairs. Leaves from ovate-lanceolate to broadly cordate, shortly stalked and entire or slightly toothed. The violet or bluish flowers occur usually singly in the axils of the leaves on long pedicels. Calyx 3 lines to 4 lines long, tomentose, five-partite. Petals four to six lines long, rarely white. Stamens numerous, staminal column very short. Style single, with a trifid stigma.

Plate CX.—*Howittia trilocularis*. The Shrub Mallow.

A. Fruit opened out.
B. Stigma enlarged.
C. Fruit from above.
D. Vertical section through flower.
E. Branch with flowers and fruit.
F. Branch showing variation in leaf shape.

Plate CXI.—*Commersonia Fraseri*. The Blackfellow's Hemp.

A. Flowering twig.
B. Under surface of tomentose calyx.
C. Flower (enlarged)
D. Part of flower showing a sepal (dark), a petal and parts of the staminal ring with six staminodes and three fertile stamens.

BOTANIC & DOMAIN GARDENS

Habitat.—A native of South-Western, Southern and Eastern Victoria, specific localities being coast ridges of Gippsland, Victoria Ranges and Tattiara country, also in South Australia and New South Wales.

Timber.—Too small to be of any present economic value, but is light and can be used for walking sticks.

STERCULIACEAE.

A small mainly tropical order of 48 genera and about 700 species of trees, shrubs or even herbs yielding such important products as cocoa or cola nuts, and containing a valuable tropical timber tree in Heritiera. The projecting buttresses of *Heritiera fomes* form natural boards. A few forms develop as climbing tropical lianas. Leaves alternate. Sepals valvate. Petals sometimes absent, often small. Stamens in two rings, the outermost often reduced to staminodia or even absent. Ovary sessile, or together with the stamens raised on a stalk above the petals, usually five partite, each chamber with two or more seeds. Fruit usually dry and capsular, sometimes separating into cocci, or forming a cluster of large follicles in *Brachychiton*. Seed with more or less endosperm.

Commersonia Fraseri J. Gay. "Blackfellows Hemp." (Plate CXI.)

Description.—*Commersonia* is a small genus of ten species mainly confined to Tropical Asia and Australia, consisting of trees or shrubs with serrate or segmented leaves often covered with stellate hairs. It is characterized by its short staminal tube with three partite petaloid staminodia.

C. Fraseri is a tall shrub growing to a height of 15 feet to 25 feet with tomentose or hirsute branches and many-flowered cymes which are shorter than the leaves.

The calyx is tomentose, fully three lines in diameter, the lobes acute. Petals with a very short broad concave base, the limb oblong-spathulate, nearly as long as the calyx. Stamens five on very short filaments. Staminodia linear-spathulate, as long as the petals. Capsule large, densely covered with soft villous hairs. Seeds are apparently germinable up to the second or third year.

Habitat.—Of limited range in Victoria being confined to the East (Genoa River and valleys under Mount Imlay).

The fibrous bark was used by the natives for cordage, weaving net bags and other purposes.

Timber.—Too small to be of economic value.

Plate CXII.—*Brachychiton populneus.* The Currajong.

A. Branch showing leaves.
B. Trifid leaf.
C. Cluster of stalked follicles developed from a flower.
D. Branch showing flowers.
E. Male flower opened out.
F. Central column from male flower, the anthers clustered at the top.
G. Gynaeceum from female flower with twisted styles and free stigmas, and the rudimentary stamens at the base.

Brachychiton populneus, R.Br. "Currajong." (Plate CXII.)

Description.—The small genus *Brachychiton* of eleven wholly Australian species is closely related to the larger and more widely distributed genus *Sterculia*. The latter has the seeds free in the fruit, whereas in the former the seeds are enclosed in a spongy ingrowth of the fruit wall.

B. populneus is a stout stemmed tree growing to a height of 20 feet to 60 feet, quite glabrous, except the flowers. The leaves are on long petioles, entire and 2 inches to 3 inches long, ovate to ovate-lanceolate. Calyx broadly campanulate, seven to nine lines diameter when fully expanded. Petals absent as in *Sterculia*. Staminal column glabrous, stamens fifteen rarely ten, ovary slightly tomentose. Follicles about 2 inches to 3 inches long, nearly ovoid on stalks of 1 inch to 2 inches.

Habitat.—A native of North-East and East Victoria, along the Upper Murray and granite ranges of the Snowy and Hume Rivers and their tributaries; also extending to New South Wales and Queensland. This handsome and valuable tree is in rapid process of extinction in its native localities owing to its being cut down in times of drought so that stock may browse on its foliage. The seeds appear to remain germinable in the soil for at least three years, but seedlings are quickly eaten down if not protected. It is a handsome avenue tree, often grown in South Europe for this purpose or as a decorative tree. The fibre from the bark was used by the natives for making cordage, nets, &c., and hence arises the native name of "Currajong," which is a general term for a fibre yielding plant.

Timber.—The timber could be used for a variety of purposes, but as the tree is of slow growth, it is hardly of service as an economic timber tree, the natural local supply being now very scarce and almost at vanishing point. It is, however, a tree well worthy of protection from destruction. Although it will grow on poor rocky soil in warm climates, it does better on rich soils and requires a fair rainfall during part of the year. Its roots penetrate deeply after water. It does not stand frost well and does not thrive at cold, high or exposed situations in the southern part of the State.

EUCRYPHIACEAE.

A very small but peculiar order containing a single genus of four species, two of which grow in Chili and two in Australia. It is characterized by its four sepals cohering at their tips and failing off as a cap when the flower opens. Four petals. Stamens numerous in several rows. Ovary of five to fifteen united carpels with free styles, the carpels separating in the ripe fruit. Handsome trees with evergreen foliage. The

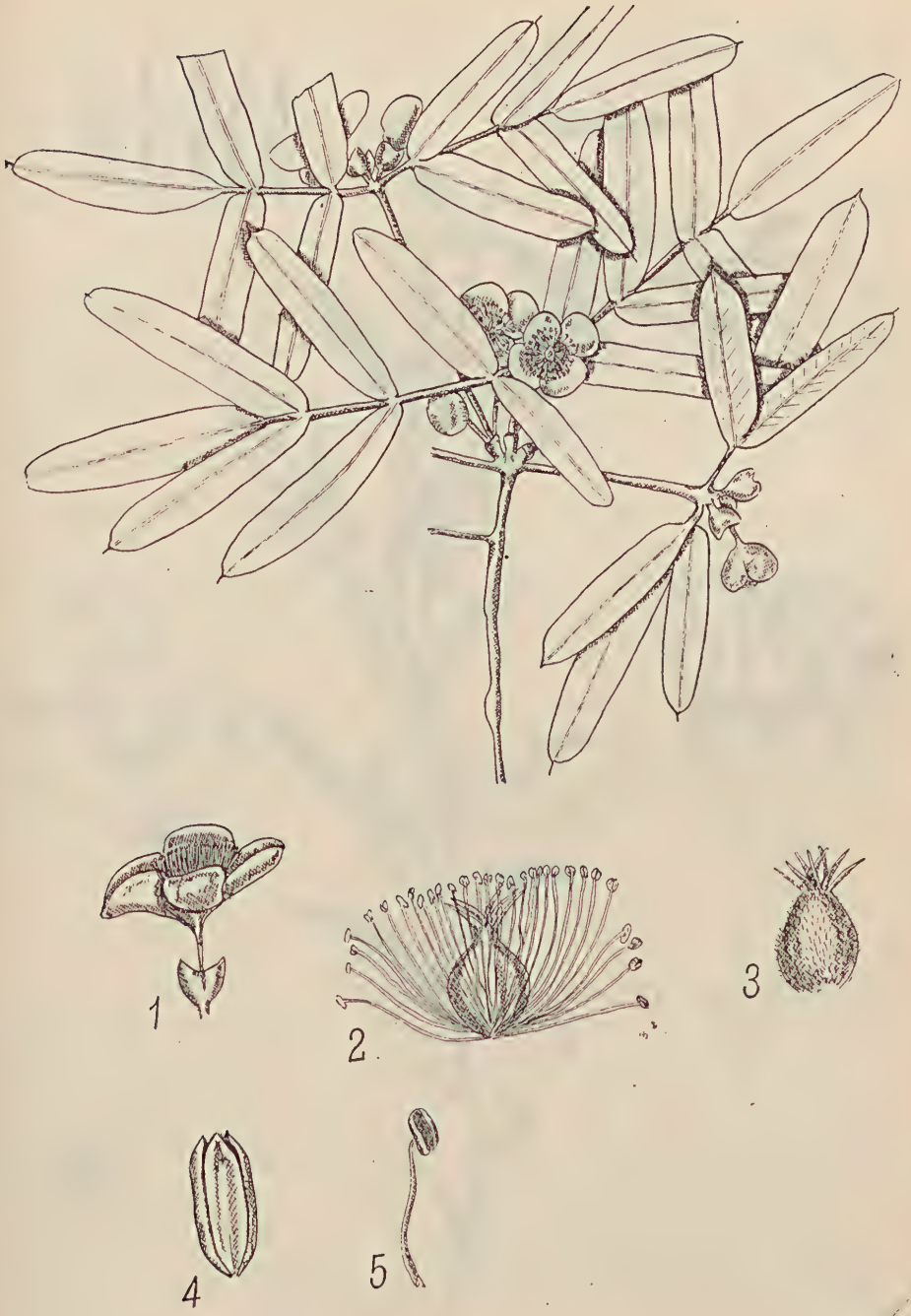


Plate CXIII.—*Eucryphia Moorei.* The Pinkwood.

1. Flower.
2. Ovary and stamens.
3. Ovary.
4. Dehiscing capsule.
5. Stamen.

Plate CXIV.—*Hymenanthera dentata.* The Tree Violet.

A. Branch with staminate flowers.
B. Flower (magnified).
C. Flower opened to show staminal column.
D. Staminal column cut open and seen from inside.
E. Berry with calyx.

wood of the Chilian species is durable and is valuable for a variety of purposes. The leaves of two species are entire (*E. cordifolia*, Chili. *E. Billardieri*, Tasmania), and of two species are pinnate (*E. glutinosa*, Chili and *E. Moorei*, Victoria and New South Wales).

Eucryphia Moorei, F.v.M. "Pinkwood," or "Stinkwood." (Plate CXIII.)

Description.—A tree usually about 15 feet to 25 feet, with gummy buds and pubescent young shoots and foliage. Leaves pinnate, leaflets usually nine to eleven, narrow oblong, entire, the terminal one often 1½ inches to 2 inches long, the basal ones shorter. Flowers white, often 1 inch in diameter, with broad petals. Stamens numerous. Capsules usually about ½ inch long.

Habitat.—In Victoria confined to East Gippsland and representing an extension of the New South Wales flora into Victoria. This handsome tree is well worthy of garden cultivation on account of its large flowers and handsome pinnate evergreen foliage. It prefers rich moist soils and does not thrive in very cold, dry or exposed localities.

Timber.—Its pinkish, close-grained, rather tough wood is useful for cabinet work when it can be obtained in sufficient quantity. It is somewhat similar in character to that of apple or pear and forms good axe and pick handles. A cubic foot seasoned weighs 46 lb. to 49 lb. Transverse breaking stress (1 ft. x 1 in. x 1 in.) averages 1,000 lb.

VIOLACEAE.

A small but widely spread order of fifteen genera and about 350 species, of which over 200 belong to Viola, mainly herbaceous, but including a few shrubs or small trees. Calyx five, petals five, stamens five alternating with the petals, the anterior pair of stamens often each with a spur, projecting into a hollow spur developed from the base of the anterior petal. Ovary of three carpels with a single loculus and usually three parietal placentas. Fruit a capsule opening in three valves or rarely a berry. Only one species of *Hymenanthera* attains fairly large dimensions in Victoria. It is characterized by the almost sessile stamens, with the anthers united into a tube around the ovary and with an erect scale on the back of the connective. The genus contains four species and is confined to Australia and New Zealand.

Hymenanthera dentata, R.Br. "Tree Violet." (Plate CXIV.)

Description.—A tall shrub 10 feet to 20 feet high. Leaves ½ inch to 1½ inches long, sessile or narrowed into short petioles. Flowers axillary, sometimes polygamous on very short stalks, solitary or two together.

Sepals orbicular. Petals five, free. Stamens five. Anthers almost sessile, more than twice the length of the calyx, and with inflexed tips within the staminal column. Stigma three lobed and ovary with three ovules, or more usually two lobes and two ovules. Berry purplish in colour with one to two rounded seeds. The seeds do not appear to remain germinable beyond the second or third year.

Habitat.—A native of the South-West, South, North-East and East Victoria, on shady banks of rivers, creeks and rivulets and in the fissures of rocks up to the highest summits of the Australian Alps ; native also to New South Wales and Tasmania.

Timber.—A useful garden shrub, but the wood is too small to be of much value. It has been used for turnery.

THYMELEAE.

A widely spread order of trees or shrubs, rarely herbs, containing 38 genera and about 400 species, most abundant in sub-tropical zones. A naturally well-defined order, the flowers usually hermaphrodite and usually four, more rarely five, partite. The receptacle is prolonged into a tube, often coloured and bearing the sepals, petals and anthers. Sepals often coloured. Petals simple, or three partite or small or absent (*Daphne, Pimelea.*) Flowers sometimes crowded and surrounded by bracts. Stamens four or eight, rarely two. Ovary one-chambered, rarely two-chambered. Fruit a nut, a berry or a drupe and usually indehiscent.

Many species are ornamental garden plants (*Daphne, Pimelea*) and most contain a strong burning neuro-muscular poison, *Daphnin,* which blisters the skin. Small doses act as an emetic and purgative. The bast fibres of most *Thymeleae* are very strong and can be used for twine or paper making.

PIMELEA.

The genus is easily recognized by the absence of petals and by its two stamens inserted on the receptacular tube opposite to the two outer calyx segments. The sepals are usually white or yellow and the flowers are rather small and are often grouped in heads surrounded by bracts. Occasionally male and female flowers occur in the head. Ovary one-chambered, one-seeded. Fruit a nut or a drupe. The seeds appear to be short lived. Samples of both the following species gave no germination in the third year.

A large genus of about 80 species confined to Australasia, and usually shrubby. A few species are cultivated in gardens or in Europe in green houses. The tough fibrous bark can be used for tying, or for cordage. Several species are suspected of being poisonous to stock.

Plate CXV.—*Pimelea axiflora*. The Tough Rice-flower.

1. Developing flower.
2. Insertion of flower.
3. Male flower cut open with unfruitful carpel.
4. Stamens in front, back and side view.
5. Face and side view of dehiscing anthers.
6. Carpel.
7. Female flower.
8. Face view fruit.

9 and 10. Vertical and transverse section of fruit.

Plate CXVI.—*Pimelea microcephala.* The Small-head Rice-flower.

1. Head of flowers.
2. Single flower.
3. Stamen.

Pimelea axiflora, F.v.M. "Tough Rice-flower." (Plate CXV.)

Description.—A glabrous shrub several feet in height, rarely 15 feet to 20 feet. Leaves linear or narrow, lanceolate, acute tapering into a short petiole, 1 inch to 2 inches or even 3 inches long. Flowers small, cream colour, in small axillary sessile heads, with two to four small involucral bracts resembling the foliage leaves, the male flowers numerous, the females few in the head. Perianth glabrous or slightly hairy, four-partite. Filaments very short. Stamens usually two. Fruit about two lines long with a membranous epicarp, and a single seed.

Habitat.—A native of South, North-East and East Victoria, on the Dandenong Ranges, Ben Nevis, Mount Macedon, &c.; also in Western Australia, South Australia, New South Wales, Queensland and Northern Australia.

Timber.—Too small to be of economic value. The tough bark yields a strong fibre and can be used as bast for tying plants or for weaving mats, &c.

Pimelea microcephala, R.Br. "Small-head Rice-flower." (Plate CXVI.)

Description.—A much branched spreading shrub, rarely 15 feet to 20 feet high with opposite linear-lanceolate, acute or obtuse leaves from $\frac{1}{4}$ inch to 1 inch long. Flower heads, small, terminal, with two to four involucral bracts resembling foliage leaves. Flowers male or female. The male perianth almost two lines long and silky hairy, with usually four lobes and two nearly sessile stamens at the throat of the perianth. Female perianth short and villous. Fruit yellowish, dry with a membranous epicarp.

Habitat.—A native of North-West Victoria, usually at lower elevations than the preceding species, as along the Avoca and Murray Rivers. Also in Tasmania and New South Wales.

Timber.—Too small to be of economic value. The tough bark yields a strong fibre.

MYRTACEAE.

A large and widely spread order of shrubs and trees containing about 3,000 species. It has its main development in Tropical America and in Australia. Many species have edible (*Guava*, *Jambosa*) or succulent (*Eugenia*) fruits, but in Australia, with the exception of *Eugenia*, the fruit is dry and capsular, and often persists on the tree for years (*Callistemon*), the seed being shed after bush fires or drought years. It includes very many valuable timber trees, and in fact the majority of the timbers of Australia are derived from this order. Among products of great technical

Plate CXVII.—*Backhousia myrtifolia*. The Grey Myrtle.

1. Flower with single stamen at side.
2. Flower in section, the petals and stamens removed.
3. Petal.
4. Ovary in transverse section.

or medicinal value, kino and various essential oils are included. The flowers are hermaphrodite and perigynous or epigynous. Calyx four or five partite, often persistent, or more or less united or forming a deciduous cap (Bluegum). Petals four to five, often united to form a deciduous cap on the flower bud, or reduced or absent. Stamens usually numerous. Ovary of several united carpels, with several or five, four, three, rarely one, compartments each usually with several, rarely with one or two seeds. Fruit a berry, drupe or capsule. Seeds without endosperm. Leaves opposite, or less commonly alternate, evergreen, bearing oil glands. The timber always belongs to the hardwood type, and is usually very durable and elastic and is readily split. In buildings the timber has a low inflammability and a short glowing period when ignited. Eucalyptus beams often stand fires which destroy iron girders and reinforced concrete. The harder woods, however (Redgum, Box, &c.), are valuable firewoods, burning slowly and giving out much heat.

Of the two main sections of the order, the *Myrtae*, which has more or less berry like fruits, includes only one representative in Victoria (*Eugenia*), whereas the second section, the *Leptospermoideae*, has dry, usually capsular fruits, and it includes most of the Australian *Myrtaceae*, including *Eucalyptus*, *Backhousia*, *Tristania*, *Angophora*, *Leptospermum*, *Callistemon* and *Kunzea*. The *Leptospermoideae* are in fact a characteristic Australian development and they form the main feature of the Australian bush and forest flora.

Backhousia myrtifolia, Hook and Harvey. "Grey Myrtle." (Plate CXVII.)

Description.—*Backhousia* is a small genus of five species in Queensland and New South Wales, one species extending to Victoria. There are four petaloid persistent sepals, four rounded petals, numerous stamens with versatile anthers and a two chambered ovary splitting when dry into two carpels. *B. myrtifolia* is a tall shrub or small tree sometimes 20 feet to 40 feet high with myrtle-like foliage. Leaves 1 inch to 2 inches long, narrowed into a petiole of one to two lines. Flowers white in small cymes sometimes contracted into heads on stalks of $\frac{3}{4}$ inch to 1 inch. Ovary inferior, ovules eight to ten in each cell. Fruit enclosed in the calyx tube.

Habitat.—Of limited range in Victoria being confined to the east, (Gippsland, &c.); also in Queensland and New South Wales, where it is usually taller.

Oil.—The leaves yield 0·3 to 0·7 per cent. of a fragrant brownish yellow oil, containing 80 per cent. elemicin, with a little pinene and paraffin.

Plate CXVIII.—*Tristania laurina.* The Kanooka.

1. Abnormal flower, four instead of five partite.
2. Fruit.
3. The same from above.

Timber.—Pinkish grey with a dark brown centre when fully grown. Very hard, tough, straight and close-grained. Useful for tool handles, carriage building, and wheels, turnery and constructional work when of sufficient size. A cubic foot weighs 65 lb. Transverse breaking stress (3 ft. x 3 in. x 3 in.) averages 10,000 lb.

Tristania laurina, R.Br. "Kanooka." (Plate CXVIII.)

Description.—*Tristania* is a genus of 20 species spread over Eastern Australia and Malaysia. It is characterized by the clustering of the stamens into five groups, each opposite a petal. *T. neriifolia* yields valuable strong timber, as do other species, while *T. obovata* yields very good charcoal.

T. laurina is the only species extending to Victoria. It is a shrub in exposed situations, but in moist localities becomes a tree attaining a height of 40 feet to 60 feet. Leaves 2 inches to 4 inches long, narrowed into a petiole. Flowers yellow, in short axillary racemes of a few flowers. Petals usually five, large. Staminal bundles each with fifteen to twenty filaments. About ten ovules in each cell of ovary. Capsule obovoid or globular, three to five lines in diameter.

Habitat.—A native of East Victoria mostly on the banks of rivers in Gippsland; also in New South Wales and South Queensland.

Timber.—Pinkish grey becoming dark red at the centre. Very close grained, polishes well, apt to split on seasoning. Useful for coach and boat building, tool handles and cabinet work. A cubic foot averages 56 lb. to 60 lb. air-dry. The transverse breaking stress (3 ft. x 3 in. x 3 in.) averages 5,000 lb. to 7,000 lb.

Eugenia Smithii, Poiret. "Lilly Pilly." (Plate CXVIX.)

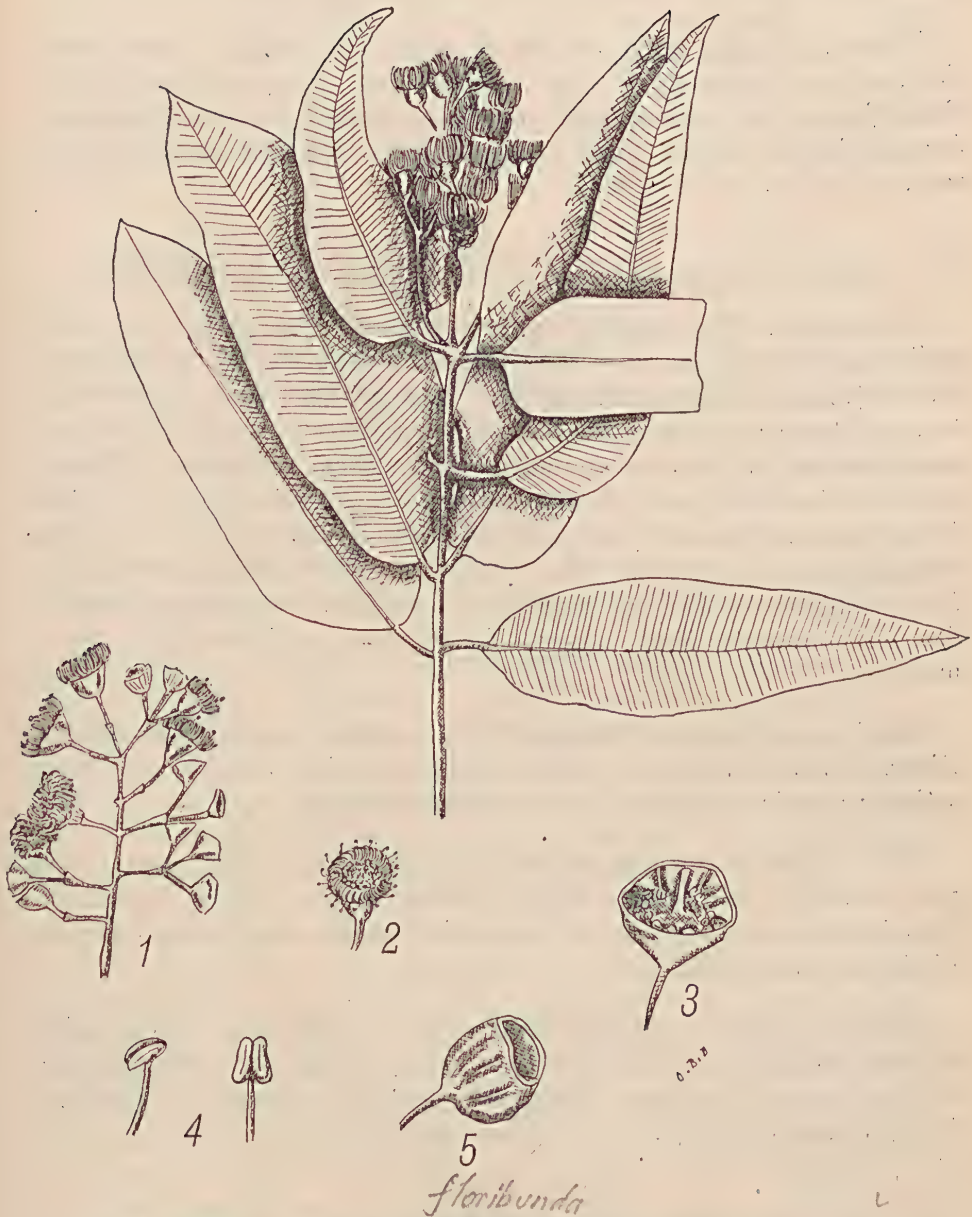
Description.—*Eugenia* is a genus of over 600 species, widely spread and most abundant in Tropical America. It is characterized by the fruit being a two, rarely three, chambered berry, the ovules numerous, the sepals free, the stigma small and capitate. Many species yield edible fruits and the timber is usually strong and valuable economically.

E. Smithii is a tree sometimes small and slender but attaining in moist gullies a height of 80 feet to 120 feet. Leaves 2 inches to 3 inches long. Flowers small and numerous in a terminal panicle. Sepals free, petals four. Stamens short, anthers small. Fruit globular, white or purple, $\frac{1}{4}$ inch to $\frac{1}{2}$ inch diameter.

Habitat.—A native of East Victoria, Snowy River, Lake King, Sealers Cove, gullies on the East of Mount Vereker and above the Tidal River, Wilson's Promontory; also in the coastal districts of New South Wales and Queensland.

Plate CXIX.—*Eugenia Smithii.* The Lilly Pilly.

1. Unexpanded flower.
2. Longitudinal section of an unexpanded flower.
3. Front and back view of a stamen.
4. Pollen grain.
5. Transverse section of young fruit.
6. Matured fruit.



floribunda

Plate CXX.—*Angophora intermedia.* The Gum Myrtle.

1. Inflorescence.
2. Young and
3. Old flower.
4. Stamens, side and front view.
5. Capsule.

Oil.—The leaves when steam-distilled yield 0·3 per cent. to 0·4 per cent. of oil, containing 80 per cent. to 90 per cent. of dextro-rotatary pinene with 4 per cent. of esters and 4 per cent. of alcohol.

Timber.—Pinkish grey, moderately hard and tough. Grain even, close, with no pronounced figure, straight, or wavy and interlocked. Useful for veneers, cabinet work, panelling, coach building and furniture. A cubic foot of air-dry timber weighs 45 lb. The bark contains 15 per cent. to 20 per cent. of tannin.

Angophora intermedia, D.C. "Gum Myrtle." (Plate CXX.)

Description.—The genus *Angophora* contains four species, all Australian and forming an interesting transition between the Metrosideros section (*Tristania*) and the Eucalypts. *Angophora* has the sepals reduced to small teeth and the petals free, while in Eucalyptus the sepals are usually absent, and the petals united to form a cap or operculum falling off when the bud opens. *A. intermedia* is a tree attaining a height of 80 feet or more and with a rough persistent bark. Leaves 2 inches to 4 inches long, oblong to lanceolate. Petals five, with broad bases and soon falling. (In *Tristania* the bases are narrow and the petals last longer usually.) Stamens numerous, free. Ovary inferior, three or four celled. Seeds numerous.

Habitat.—A native of Eastern Victoria at the mouth of the Genoa River, Mallacoota &c. A useful shade tree for avenues and plantations; also in New South Wales and Queensland.

Oil.—Although some species of *Angophora* yield 0·3 per cent. to 0·4 per cent. of oil consisting mainly of dextro-rotatory pinene with a little geraniol and sesquiterpene, the leaves of *A. intermedia* yield only a trace of oil on steam distillation.

Timber.—Pale, moderately hard, with a fairly close grain and a delicate wavy figure. Polishes well and is useful for cabinet work, panelling and general purposes. Transverse breaking stress (3 ft. x 3 in. x 3 in.) averages 8,000 lb. A cubic foot weighs 56 lb. to 58 lb.

EUCALYPTUS.

This large genus of over 200 species is confined to Australia with the exception of four Malaysian species, but is now widely planted over the temperate and sub-tropical regions of the globe. It attains its maximum development in the southern half of the continent and includes both alpine and desert species. They are evergreens and even the moisture-loving species of mountain gullies are somewhat xerophilous. With the exception of such species as the sugar and scarlet gums, they are not good shade trees, but many yield valuable "resin" (Kino) or oil. The

Eucalypts occupy an even higher position among hardwood timber trees than the pines do among softwood trees, and are unrivalled for all purposes where strength and durability are essential. As in all hardwoods, the timber is apt to warp or crack when badly seasoned. Eucalyptus timbers are specially valuable in building construction because of their difficult inflammability, and with the exception of Mallee woods, which are usually too small to be of use for construction, there is usually no after-glow on burning a splinter, just as in a properly-prepared lucifer match.

A genus of trees, mostly tall, usually with alternate leaves, often opposite when young, evergreen, except in the tropical deciduous *E. alba* and in a few species which shed their leaves in drought. Calyx usually absent or represented by small teeth (*E. tetradonta*) or when the operculum is double, as is sometimes the case, possibly represented by the outer layer. Petals united to form a deciduous operculum. Stamens numerous. Anthers parallel or divergent. Ovary of three to five carpels sunk in the thalamus. The thalamus tube, therefore, forms the outer wall of the ovary. Fruit a dehiscent capsule with three to five, rarely two (*E. phoenicea*) or six cells. The cells may vary in number from three to four or from four to five on the same individual plant.

The identification and classification of Eucalypts is a matter of some difficulty even to the specialist. Hence duplicate keys are given at the commencement of this work and a generalized one here, followed by a key for use in the field. If each key runs down to the same species and this tallies with the description and plate, the identification will be correct. Care must always be taken to use typical material. Abnormal material may lead to different identifications in different keys.

The primary divisions are based on the character of the anthers :— (1) Parallelantherae, if the anthers are parallel and open by parallel longitudinal slits (*E. globulus*, *E. goniocalyx*, *E. corymbosa*) ; (2) Renantherae, the anther lobes diverging at the base (kidney-shaped) with divergent slits, or with one curved slit like a blunt arrow head (*E. Sieberiana*, *E. obliqua*, *E. pilularis*, *E. macrorrhyncha*) ; (3) Porantherae, the anthers short, often quadrangular in section and opening by more or less terminal pores (*E. melliodora*, *E. leucoxylon*, *E. hemiphloia*, *E. oleosa*). In some cases, however, transition stages occur. For instance, in *E. populifolia* the anthers are parallel and the pores more lateral than terminal, while in *E. leucoxylon* the slit-like terminal pores, and in *E. odorata* the oval terminal pores diverge as in the Renantherae, and in *E. oleosa* the anthers open by large and rounded but lateral pores.

Other characters made use of are (1) whether the stamens are inflected or straight in the bud ; (2) whether all the stamens are fertile or some are without anthers ; (3) the shape of the buds ; (4) the arrangement of the flowers ; (5) the shape of the fruit, fruit rim and projection or non-

projection of the valves ; (6) the character of the bark ; (7) the relative length of the operculum in regard to the thalamus tube. Not one of these characters is absolutely reliable, and by relying wholly on (3) Engler places *E. tereticornis* and *E. tereticornis* var. *rostrata* in different sub-sections (*Cornutae and Ovatae*).

Even the character of straight or inflexed stamens in the bud depends upon the shape of the operculum (straight if it is long, inflexed if it is short relatively to the length of the filaments), so that when a long operculum type has a shorter one than usual some of the outer stamens may be inflexed.

According to the character of the bark Eucalypts may roughly be divided into (1) gums, with a smooth, usually not very thick and pale greenish, mottled or lead coloured bark ; (2) Iron barks with a rough dark corrugated hard and thick bark ; (3) Stringy barks with a thick brownish fibrous bark ; (4) Box barks and Peppermint barks which are intermediate between (2) and (3), the former nearer to (2), the latter to (3).

Although the types of each are quite distinct, intermediate forms are often hard to place, and the character of the bark may vary according to the locality. Every branch passes through a smooth bark stage which may persist for a variable length of time, and in general this stage persists longer at high altitudes, so that the same species may have a smooth green bark at high elevations but develop a rough iron or box bark on the butt and main branches when grown at low elevations. This applies for instance to *E. viminalis* when growing near Melbourne or in the Dandenong ranges respectively.

The detailed characters of the wood and their relative constancy or inconstancy are insufficiently known to be of much use in classification, and the bold attempt by Baker and Smith to classify Eucalypts according to their oils and to associate particular oils with certain types of venation, while it has added many facts of suggestive interest, has not lightened the difficulties of classification. The oil may vary to some extent according to the season, locality and age of the tree, and in many cases different observers ascribe very dissimilar compositions to the oils of the same species.

The whole difficulty arises from the fact that the genus Eucalyptus is in a plastic condition with imperfectly segregated species, but an observer who had travelled through a few miles of Mallee scrub and noted the almost indefinite range of variation between two or three "species" and the apparent inconstancy of any single character might feel justified in stating that the laws of heredity only apply to many Eucalypts in a general way and not in regard to single characters, i.e., that pure-bred Mallee scrubs may bear a 95 per cent. resemblance to the parent tree, but not necessarily a 100 per cent. resemblance.

EUCALYPTUS SEEDS AND THEIR GERMINATION.

All Eucalypts reproduce freely by seed, although in many species the percentage of fertile seed is not great in spite of the large seed production. Seeding, however, does not always occur every year. The seed of all species keeps for at least two or three years when dry, and also appears to last equally well in the soil. None of the seeds are hard and impermeable, so that they absorb moisture in the soil, and the arrest of their germination is probably due to the inner coats being sufficiently impermeable to retain an inhibitory percentage of carbon dioxide, particularly when the seeds are deeply buried. After clearing forest land, seedlings of such trees as Messmate, Brown Stringybark, Narrow and Broad-leaved Peppermint may continue to appear for at least five years after the last period of free seeding, whenever the surface soil is clear. After five years the chance of re-establishment is small and mainly depends upon seed blown by the wind or carried by birds from neighbouring afforested areas.

In germinating viable Eucalyptus seeds, they may frequently lie dormant in the seed bed for some months without germinating, particularly if the temperature is low, then coming up at irregular intervals instead of simultaneously (*E. coriacea*, *E. macrorrhyncha*, *E. obliqua*, &c.). Possibly the seed coats may have varying permeabilities, although none are absolutely impermeable or cuticularized. As a general rule the seeds of trees growing in dry districts germinate more rapidly and uniformly when moistened than those from a moist habitat.

The following table gives the duration of Eucalyptus seeds as far as known at present. The first column gives the species, the second the period during which the seeds will give a reasonable percentage germination if they have been preserved under favorable, i.e., cool and dry, conditions. In the case of the smaller seeds this may not be more than 10 per cent. even when fresh, owing to the large number of infertile seeds. The third column gives the longest period at which any germination has been observed and the percentage germination.

Eucalyptus Seed.	Average Age at which still Usable.	Longest Record and Percentage Germination.
E. alpina	5 years	10 years 1·2 per cent.
E. amygdalina	8 „	11 „ 4·1 „
E. Baileyana	8 „	16 „ 1 „
E. botryoides	10 „	16 „ 30 „
E. calophylla	16 „	32 „ 5 „
E. coccifera	6 „	11 „ 3·2 „
E. cornuta	10 „	22 „ 9 „
E. corynocalyx	16 „	16 „ 68 „
E. diversicolor	15 „	24 „ 11 „
E. dumosa	5 „	10 „ 5 „
E. foecunda	5 „	10 „ 3·9 „
E. globulus	6 „	20 „ 2·2 „
E. gomphocephala	8 „	30 „ 0·8 „

Eucalyptus Seed.	Average Age at which still Usable.	Longest Record and Percentage Germination.
E. goniocalyx	8 years	15 years 4 per cent.
E. Gunnii	5 „	11 „ 2·2 „
E. incrassata	5 „	10 „ 4 „
E. leptopoda	10 „	30 „ 1·2 „
E. Maideni	6 „	3 „ 82 „
E. miniata	8 „	20 „ 2·2 „
E. obcordata	7 „	10 „ 6·5 „
E. obliqua	12 „	25 „ 1·1 „
E. odorata	5 „	10 „ 10 „
E. paniculata	5 „	10 „ 4·3 „
E. patens	5 „	10 „ 8·1 „
E. pauciflora	8 „	12 „ 5·8 „
E. pilularis	10 „	11 „ 25 „
E. punctata	10 „	15 „ 7·5 „
E. rostrata	15 „	37 „ 6·1 „
E. rudis	7 „	10 „ 12 „
E. siderophloia	5 „	10 „ 2·1 „
E. Stuartiana	3 „	8 „ 2·0 „
E. tereticornis	10 „	15 „ 2·3 „
E. urnigera	5 „	11 „ 5·5 „
E. viminalis	8 „	12 „ 15 „

Origin of the genus Eucalyptus.—Fossil Eucalypts have been described as far back as the Cretaceous zone, but the supposed fossil fruits are doubtful, and the identification of Eucalypts from the leaves is no more possible in fossil than it is in existing forms. The supposed fossil Eucalypts, particularly of the Cretaceous and Eocene, probably belong to the genus Myrcia. The genus Eucalyptus appears to have been derived from Metrosideros after the continental, separation of Australia and hence not to be represented in any fossil flora outside of Australia. Its recent origin is evidenced by its plasticity, by the imperfect segregation of its species, and by their ready hybridization. One feature is that very few species are definitely adapted to special habitats. Nearly all can grow well under a wide range of conditions, not merely in Australia but in various parts of the globe where they have been planted. With the exception of the Alpine species they are more sensitive to cold than they are to high terrestrial temperatures and for the most part they only show secondary or minor xerophytic adaptations. This suggests that during the early stages in the evolution of the genus, Australia had a more equably warm climate with fewer extremes of heat and cold than at present, possibly because our continent then lay nearer to the equator and possessed a great inland sea ameliorating the climate by lessening the fluctuations of temperature and of humidity.

GENERAL KEY TO THE VICTORIAN SPECIES OF EUCALYPTUS.

A.—Anthers opening by parallel longitudinal slits *Parallelantherae* 1, 2 or 3

B.—Anthers kidney-shaped, opening by divergent slits or pores .. *Renantherae* 27

C.—Anthers opening by pores or oval slits usually terminal and the anthers often squarish in outline. .. .. .. *Porantherae* 47

PARALLELANTHERAE.

(1) Buds sessile or shortly stalked, short, often angled or ridged, operculum low, flat, broad or conical 4

(2) Bud elongated cylindrical, elliptical or obovate, the thalamus tube twice as long as the operculum and with a prominent raised edge around the sunken ovary.. 8

(3) Buds ovate or elongated thin and horn like, operculum longer than the thalamus tube 26

(4) Flowers single in the axils of the leaves .. *E. globulus.* CXXI.

Flowers at least two or three together 5

(5) Buds or fruits more or less prominently angled 6

Buds or fruits more or less prominently ridged 7

Bud and fruits not prominently angled or ridged 8

(6) Ripe fruit rounded, the valves projecting .. *E. Maideni.* CXXII.

Ripe fruit more or less angled, the valves hardly projecting or sunk below the rim .. .. *E. goniocalyx.* CXXV.

(7) Fruits nearly sessile, not twice as long as broad *E. incrassata.* CXXIX.

Fruits distinctly stalked at least twice as long as broad *E. cladocalyx.* CXXXI.

(8) Seedling leaves more or less perfoliate *E. Perriniana.* CXXXV.

Seedling leaves not perfoliate or united at their bases 9

(9) Individual fruits on prominent stalks often as long as the fruit which is large and as broad as long .. *E. longifolia.* CXXIII.

Fruit stalks prominent, flowers and fruits large, fruit longer than broad .. .. *E. corymbosa.* CXXVIII.

Individual fruits on short stalks or sessile 10

(10) Fruit valves not projecting above the rim or only slightly so .. 11

Fruit valves projecting above the rim 16

(11) Fruits contracted at the top 12

Fruits hardly contracted at the top 13

(12) Fruits pear shaped .. .. *E. maculata.* CXXXIX.

Fruits truncate globular .. .. .. *E. Gunnii.* CXXXIV.

(13) Lateral veins nearly at right angles to midrib .. *E. botryoides.* CXXIV.

Lateral veins forming an acute angle with the midrib 14

(14) Fruits in sessile clusters on a short common stalk 15

Fruits in looser clusters, the individual stalks short, but distinct *E. ovata.* CXL.

(15) Fruits longer than broad, the rim narrow, the valves often slightly projecting .. .. *E. nitens.* CXXVI.
Fruits hardly longer than broad, the rim broad
E. Kitsoniana. CXXXVI.

(16) Fruits in sessile clusters without a common stalk *E. neglecta.* CXXXII.
Fruits in more or less sessile clusters on a distinct common stalk 17

(17) Fruit valves long narrow and tooth like .. *E. oleosa.* CXXX.
Fruit valves short and broadly acute 18

(18) Operculum rounded .. .. .. *E. elaeophora.* CXXVII.
Operculum more or less pointed 19

(19) Individual fruits sessile .. .. .. *E. Stuartiana.* CXLII.
Individual fruits on short but distinct stalks 20

(20) Peduncle shorter than the flowers .. .. *E. cinerea.* CXXXVII.
Peduncle as long as or longer than the flowers 21

(21) Anthers squarish in outline 22
Anthers rounded or oval 23

(22) Fruits with a prominent rim .. *E. Bridgesiana.* CXLIII.
Fruits with a narrow rim .. .. *E. camphora.* CXXXIII.

(23) Juvenile leaves narrow and tapering .. *E. viminalis.* CXLVI.
Juvenile leaves broad, or if narrow linear not tapering .. 24

(24) Young leaves and shoots silvery-grey *E. cinerea.* CXXXVIII.
Young leaves and shoots hardly silvery-grey 25

(25) Juvenile leaves orbicular to ovate and sessile .. *E. rubida.* CXLV
Juvenile leaves ovate to lanceolate and shortly stalked
E. maculosa. CXLVIII.

(26) Operculum contracting gradually to a pointed tip
E. tereticornis. CXLVI.
Operculum contracting suddenly to a pointed tip
E. tereticornis var., *rostrata.* CXLVII.

RENANTHERAE.

(27) Buds or fruits ridged or angled .. .. *E. calycogona.* CLI.
Buds or fruits not ridged or angled 28

(28) Fruit valves projecting above the rim 29
Fruit valves level with the rim or hardly projecting above it .. 33
Fruit valves sunk well below the rim 41

(29) Fruits small with a narrow rim .. .. *E. Smithii.* CXLI.
Fruits rather large with a broad rim 30

(30) Bud rough or tuberculate .. .. .. *E. alpina.* CLXVI.
Buds smooth 31

(31) Individual fruits shortly stalked .. *E. macrorrhyncha.* CLXIV.
Individual fruits practically sessile 32

(32) Flowers in clusters of more than four, operculum obtuse
E. capitellata. CLXV.
Flowers in clusters of less than four, operculum pointed
E. santalifolia. CLXXV.

(33) Outer stamens without anthers 34
Outer stamens with anthers 35

(34) Fruit with a narrow or flat rim .. *E. Sieberiana.* CLXXXIV.
Fruit with a rounded often red rim .. *E. haemastoma.* CLXIX.

(35) Fruits large .. .. .. *E. Muelleriana.* CLXVII.
Fruits small or of medium size 36

(36) Tall trees with a straight bole frequently exceeding 100 feet and usually at high elevations 37
Smaller trees with a gnarled, twisted or branched trunk, rarely exceeding 50 feet, and usually at low elevations 39

(37) Fruits stalked in loose clusters .. *E. regnans.* CLXXXIII.
Fruit in compact clusters, the individual fruits almost or quite sessile 38

(38) Operculum narrowed sharply to a point. Fruits large *E. pilularis.* CLXXVII.
Operculum contracting gradually to a point. Fruits small *E. eugenioides.* CLXVIII.

(39) Operculum about as long as the thalamus tube *E. piperita.* CLXXVI.
Operculum much shorter than the thalamus tube 40

(40) Leaves at least five times as long as broad *E. amygdalina.* CLXIII.
Leaves hardly more than three times as long as broad *E. dives.* CLXII.

(41) Operculum long and narrow, about as long as the thalamus tube *E. stellulata.* CLXI.
Operculum not as long as the thalamus tube, usually blunt or flat 42

(42) Lateral veins nearly parallel with the midrib *E. pauciflora.* CLXXXII.
Lateral veins divergent from the midrib 43

(43) Buds nearly globular .. .. .. *E. gigantea.* CLXXX
Buds longer than broad 44

(44) Fruits with a broad rim .. .. *E. Consideniana.* CLXXXI.
Fruits with a narrow rim .. .. 45.

(45) Fruits rather large and usually few together *E. obliqua.* CLXXIV.
Fruits rather small, and usually more than five together .. 46

(46) Leaves lanceolate .. .. *E. radiata.* CLXXIX.
Leaves almost linear .. .. .. *E. vitrea.* CLXXIII.

PORANTHERAE.

(47) Operculum as long as or nearly as long as the thalamus tube .. 48
Operculum about one-third the length of the whole bud or less .. 53

(48) Mallee shrubs rarely much exceeding 15 feet 49
Trees regularly over 20 feet high 50

(49) Leaves usually with a hooked tip .. .. *E. uncinata.* CLVII.
Leaves without a hooked tip 51

(50) Young buds angular surrounded by pale deciduous bracts. Branchlets somewhat quadrangular *E. polybractea.* CLVIII.
Young buds and branchlets rounded .. *E. viridis.* CLX.

(51) Stamens all fertile .. .. .. *E. hemiphloia.* CLVI.
Outer stamens without anthers 52

(52) Operculum distinctly pointed .. *E. leucoxylon.* CLXXIII.
Operculum flat or slightly pointed and with resinous dots.
E. polyanthemos. CLII.

(53) The outer stamens usually with no anthers or with small abortive ones 54
The stamens all fertile or only occasionally with odd sterile ones.. 58

(54) Fruits on stalks nearly as long as the fruit itself 55
Fruits stalks much shorter than the fruit 56

(55) Leaves much longer than broad .. *E. sideroxylon.* CLXXII.
Leaves nearly as broad as long .. *E. polyanthemos.* CLII.

(56) Operculum blunt or obtuse .. .. *E. fasciculosa.* CL.
Operculum pointed or conoid 57

(57) Tree with a lead coloured sub-fibrous box bark *E. melliodora.* CLXXI.
Tree with a pale or brownish hard iron bark .. *E. paniculata.* CLXX.

(58) Flowers in axillary or lateral umbels 60
Flowers in terminal nearly leafless panicles 59

(59) Leaves long, narrow dull .. .. .. *E. bicolor.* CXLIX.
Leaves broad, thick and shiny .. .. *E. Behriana.* CLV.

(60) Fruits more or less globose or rounded .. *E. Bosistoana.* CLIV.
Fruits hardly globose 61

(61) Leaves narrow lanceolate .. .. .. *E. odorata.* CLIX.
Leaves broadly ovate or rounded .. .. *E. Baueriana.* CLIII.

FORESTERS' FIELD KEY TO VICTORIAN EUCALYPTS.

Alpine shrubs not exceeding 15 feet 1
Mallee shrubs or small trees 2
Trees usually tall not confined to alpine or Mallee regions 12

(1) Adult leaves not auriculate or stem clasping—
(*a*) Native to the Grampians .. .. *E. alpina.* CLXVI.
(*b*) Native to the Buffalo Ranges .. *E. pauciflora.* CLXXXII.
Adult leaves auriculate or stem clasping—
(*a*) Native of Dargo High Plains .. *E. Perriniana.* CXXXV.
(*b*) Native of Baw Baw and St. Bernard .. *E. Gunnii.* CXXXIV.

(2) A " Gippsland Mallee " only found at Livingstone Creek, Gippsland .. .. *E. neglecta.* CXXXII.
Gippsland Mallee at Buchan *E. eugenioides* var. *nana.* CLXVIII.
Tree mallees of the North-West or on coastal sand dunes .. 3

(3) Small trees growing to a height of 15 feet to 30 feet or even 40 feet 4
Shrubs rarely exceeding 15 feet 6

(4) Bark smooth 5
Bark rough except towards the ends of the branches
E. bicolor. CXLIX.

(5) Heart-wood brown. Butt enlarging much at the ground level *E. incrassata.* CXXIX.

Heart-wood red to reddish-brown. Butt not enlarging greatly at ground level .. .. *E. Behriana.* CLV.

(6) Buds four angled. Bark smooth. Heart-wood brownish *E. calycogona.* CLI.

Buds not four angled 7

(7) Leaves mostly with curved or hook like tips (Bark smooth. Heart-wood brown) .. .. .. *E. uncinata.* CLVII.

Leaves without hooked tips 8

(8) Branchlets quadrangular .. .. *E. polybractea.* CLVIII.

Branchlets rounded or hardly angular 9

(9) Bark smooth 10

Bark pale and smooth on the branches, dark and rough towards the butt 11

Bark red and smooth on the branches, becoming rough towards the base. Fruit very small .. .. *E. Behriana.* CLV.

(10) Fruits nearly globular .. .. *E. santalifolia.* CLXXV.

Fruits obovoid truncate .. *E. incrassata* var. *dumosa.* CXXIX.

(11) Heart-wood yellow .. .. *E. viridis.*

Heart-wood reddish brown .. .. .. *E. oleosa.* CXXX.

(12) Smooth barks or gums, occasionally with rough bark at the extreme base 13

Half barks, the butt with rough bark, the branches with smooth bark* 28

Bark dark-grey or black, hard, indurated, more or less corrugated or fissured (Iron barks) 43

Bark brown thick fibrous and stringy (Stringy barks) 44

Bark lamellar, brittle and flaky (Scale barks) 47

Bark rough to the ends or nearly to the ends of the branches, but not iron barks, stringy barks or scale barks 48

(13) Bark grey or patchy, slightly roughened *E. maculata.* CXXXIX.

Bark smooth and shining, or rough at the butt only 14

(14) Rain forest species in sheltered valleys or avoiding exposed northern slopes and with shaft-like columnar stems 15

Growing in more exposed situations, the main stem soon breaking into branches, but often of considerable length 18

Growing in exposed or rather dry situations, rarely large and usually the branches longer than the unbranched portion of the stem 24

(15) Operculum smooth. Fruits under $\frac{3}{4}$-inch diameter 16

Inner operculum warty, fruits $\frac{3}{4}$-inch diameter or more *E. globulus.* CXXI.

(16) Buds angular or ridged .. .. *E. goniocalyx.* CXXV.

Buds not angular or ridged 17

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* The bark is usually rough up to the first branches, but the rough bark may be confined to the basal third of the butt. On the other hand, many gums have a rough bark at the extreme base, and in *E. viminalis*, when growing near sea level, the rough bark may extend right up the trunk. In *E. regnans* the bark may be rough at the base for 10–12 feet.

(17) Fruits rather small, ¼-inch diameter or less *E. regnans.* CLXXXIII.
Fruit rather large, ¼-inch diameter or more .. *E. Maideni.* CXXII.

(18) Wood red 19
Wood pale red 20
Wood pale yellow or white, or pinkish yellow 21

(19) Growing on the banks of streams *E. tereticornis* var. *rostrata.* CXLVII.
Growing in forests.. .. .. .. *E. tereticornis.* CXLVI.

(20) Flowers usually in threes .. .. .. *E. rubida.* CXLV.
Flowers in clusters of four to twenty *E. maculosa.* CXLVIII.

21) Fruits with a prominent brown or reddish rim *E. haemastoma.* CLXIX.
Fruits without a prominent brown or reddish rim 22

(22) Small alpine tree or shrub. Adult leaves auriculate or stem-clasping .. .. .. *E. Perriniana.* CXXXV.
Medium sized trees with ordinary adult leaves 23

23) Grows in moist Gippsland gullies. Flowers white. Timber pale *E. Smithii.* CXLI.
Grows on more exposed plains and dry slopes from Bendigo to the Wimmera, &c. Flowers pale yellow or pink. Timber usually pinkish yellow .. .. .. *E. leucoxylon.* CLXXIII.
Grows on plains and hills on rich moist soils. Flowers white and timber pale yellow .. .. .. *E. viminalis.* CXLIV.

(24) Timber dark reddish brown .. .. *E. fasciculosa.* CL.
Timber pale 25

(25) A dwarf tree under 20 feet or a shrub *E. Kitsoniana.* CXXXVI.
Trees 20 feet or more high (excepting the alpine forms of *E. pauciflora*) 26

(26) Alpine trees growing up to 5,000 feet elevation. Fruits not ribbed 27
Not alpine. Fruits more or less ribbed. .. *E. cladocalyx.* CXXXI.

(27) Rim of flower very open. Flowers five to ten together *E. pauciflora.* CLXXXII.
Rim not specially expanded. Flowers small, numerous in the clusters .. .. *E. stellulata.* CLXI.
Rim not specially open. Flowers in threes or fewer *E. Gunnii.* CXXXIV.

(28) Growing in swamps .. .. .. *E. ovata.* CXL.
Not growing in swamps 29

(29) Wood reddish brown .. .. *E. polyanthemos.* CLII.
Wood pale or pale brown 30

(30) Bark of the Peppermint type 31
Bark less fibrous and of the box type 38

(31) Tall trees often much exceeding 50 feet in height 32
Small or medium sized trees rarely much exceeding 30 feet in height 34

(32) Rough bark at the butt, reddish, stringy, thick and closely matted *E. gigantea.* CLXXX.
Rough bark approaching that of an iron bark, but softer and less regularly furrowed or corrugated 33

(33) Stem much buttressed at the base. Growing mostly at 1,000 feet to 5,000 feet .. .. .. *E. Sieberiana.* CLXXXIV.

Stem not much buttressed at the base. Growing mostly at elevations up to 1,000 feet .. .. *E. pilularis.* CLXXVII.

(34) Leaves without any odour of peppermint *E. Consideniana.* CLXXXI.

Leaves slightly lemon scented .. .. *E. vitrea.* CLXXVIII.

Leaves with a strong peppermint aroma 35

(35) Flowers numerous (20 to 40 in the clusters) .. *E. radiata.* CLXXIX.

Flowers less than ten or twelve in the clusters 36

(36) Fruits more or less contracted at the top .. *E. piperita.* CLXXVI.

Fruits hardly contracted at the top 37

(37) Leaves half to one-third as broad as long .. *E. dives.* CLXII.

Leaves long and narrow, four or five times as long as broad *E. amygdalina.* CLXIII.

(38) Inner bark bright yellow .. .. .. *E. melliodora.* CLXXI.

Inner bark pale 39

(39) Bark on trunk rather fibrous and reddish brown *E. cinerea.* CXXXVII.

Old bark sub-fibrous, not reddish brown 40

(40) Old bark black at the butt. Valves of fruit projecting *E. camphora.* CXXXIII.

Old bark greyish or dark, but hardly black. Valves sunk or slightly projecting 41

(41) Operculum double .. .. .. *E. hemiphloia.* CLVI.

Operculum single 42

(42) Timber brownish or reddish yellow. Sap wood white *E. Bosistoana.* CLIV.

Timber pale to reddish .. .. .. *E. ovata.* CXL.

Timber pale or white .. .. .. *E. nitens.* CXXVI.

(43) Timber pale to light brown .. .. *E. paniculata.* CLXX.

Sap-wood yellow, heart-wood red .. *E. sideroxylon.* CLXXII.

(44) Fruits globose with a prominent red rim 45

Fruits globose or pear-shaped without a prominent red rim .. 46

(45) Operculum obtuse, fruits in nearly sessile heads *E. capitellata.* CLXV.

Operculum pointed. Fruits on stalks *E. macrorrhyncha.* CLXIV.

(46) Inner bark yellow. Fruit hemispherical to semi-ovate. Timber pale yellow to brownish yellow .. *E. Muelleriana.* CLXVII.

Inner bark brown to yellow. Fruit truncate globose. Timber pale brown to reddish brown .. *E. eugenioides.* CLXVIII.

Inner bark not yellow. Fruit pear-shaped. Timber pale straw colour with prominent pores .. .. *E. obliqua.* CLXXIV.

(47) Wood red and exuding red kino from gum veins when cut *E. corymbosa.* CXXVIII.

(48) Timber red 49

Timber pale 50

(49) Flowers in clusters of three to four, each flower stalked *E. longifolia.* CXXIII.

Flowers nearly sessile in clusters of four to ten *E. botryoides.* CXXIV.

(50) Crushed flowers with a smell like apples .. *E. Stuartiana.* CXLII.
Without any distinct aroma of apples 51
(51) Leaves hardly longer than broad .. .. *E. Baueriana.* CLIII.
Leaves several times longer than broad 52
(52) Leaves mostly under 3 inches to 4 inches long *E. odorata.* CLIX.
Leaves mostly over 3 inches to 4 inches long 53
(53) Flowers and fruits sessile on short peduncle *E. elaeophora.* CXXVII.
Flowers and fruits shortly stalked on common peduncle
E. Bridgesiana. CXLIII.

EUCALYPTUS OIL.

The oil is formed in glandular cavities in the leaves analogous to those in the peel of an orange. In the Bloodwood group of Eucalypts (*E. corymbosa, E. maculata, E. citriodora,* &c.) and in *Angophora lanceolata,* oil ducts occur in the pith which are formed by the linking up of chains of oil glands. These extend through the petiole into the leaves, but whether they serve for storage or for translocation is uncertain.

The oil is best obtained by the steam distillation of leaves either green or within a period of a week to ten days after the leafy twigs or leaves have been clipped from the branches or coppice shoots. The oil floats on the water in the receiver of the condenser still and is run off by a side tap. The water removes most of the water-soluble products of distillation, such as acetic acid, formic acid, methyl, ethyl and amyl alcohols and aldehydes. The residual oil may contain the following products:— cineol, eudesmol, aromadendral, citral, citronellal, piperitone, and its alcohol piperitol, the alcohol geraniol and geraniol esters, aromadendrene, pinene, phellandrene. The last-named is used in the flotation of minerals, whereas cineol appears to be the important medicinal product.

CINEOL (EUCALYPTOL). $C_{10}H_{18}O$.

It is an oxide first obtained pure from Artemisia Cina, but is also present in the oil of Melaleuca (over 60 per cent.) and in that of the Myrtle, Lavender, Rosemary, Sage, and Laurel. It crystallizes out on freezing and also forms crystalline compounds with cold phosphoric acid, bromine, hydrochloric and anhydrous hydrobromic acids. The last solid dissociates again on adding water. It can be estimated in this way or by forming the phosphoric acid compound, which contains 59·6 of cineol and dissociates in warm water. It distills at 160° to 180° C., B.P. 177° C.; M.P.–1° C.; Sp. gr. at 20° C. of 0·93; ref. index at 50° C. = 1·458. Recognition: Dissolve iodol in the oil and warm; greyish-green crystalline precipitate soluble in alcohol.

EUDESMOL. $C_{10}H_{16}O$.

It crystallizes out, on allowing oil containing it to evaporate slowly. It melts at 79° C, and sublimes slowly above 100° C. It is mainly found in the fraction of oil, distilling between 276° and 290° C. If abundant the oil becomes pasty or solid on cooling after distilling. It dissolves in glacial acetic acid, becomes liquid and purple with cold nitric acid and combines with bromine.

Eudesmol is a sesquiterpene alcohol which is possibly the precursor of cineol. The crystals sometimes liquefy on keeping, but can be reobtained by dissolving the liquid in ether, removing resinous acids by shaking with watery potash, evaporating and subliming. Eudesmol boils at 156° C. at 10 mm. pressure, has a refractive index of 1·516 at 20° C.; sp. gravity at 20° C. of 0·9884; rotation of 31° in 12 per cent. solution in chloroform.

AROMADENDRAL. $C_{10}H_{14}O$.

This is an aromatic laevo-rotary aldehyde of the sesquiterpene, aromadendrene, boiling at 210-215° C. It is found in the later fractions on fractional distillation. It forms a yellow crystalline solid with phenylhydrazine and is oxidized by alkaline potassium permanganate to an acid and to cineol. With an acid solution of potassium bichromate, the aromadendric acid alone is formed. It occurs associated with two other aromatic aldehydes, cuminal, $C_{10}H_{12}O$ and cryptal, $C_{10}H_{16}O$. The two former produce solid compounds when shaken with 30 per cent. sodium bisulphate, but cryptal forms a liquid compound. According to Penfold "aromadendral" is merely a mixture of cuminal and phellandrene in varying proportions.

PIPERITONE. $C_{10}H_{16}O$.

A ketone giving the peppermint aroma. It is found mainly in the fraction of the oil distilling at 227–240° C. It is optically inactive when examined after ordinary distillation, but occurs naturally in a laevo-rotatory form and slowly yields a crystalline compound with saturated sodium bisulphite. Boiling point 224–225° C. It forms thymol with ferric chloride, and yields menthol on reduction.

AROMADENDRENE.

Is a sesquiterpene and is the cause of the pink colour when Eucalyptus oil is treated with phosphoric acid. A solution in acetic acid gives with hydrochloric acid or with bromine crimson or red turning slowly to violet and then with bromine to blue. Boiling point 260–265° C. at 760 mm. pressure or 125° C. at 10 mm. pressure; sp. gr. 0·9222; refractive index at 20° C., 1·5.

PHELLANDRENE AND PINENE.

Are both terpenes, the latter closely related to pine turpentine.

PINENES. $C_{10}H_{16}$.

Are either dextro- or laevo-rotatory. Boiling point 156° C. Density 0·86 at 20° C. They give a turpentine aroma to certain oils and distill over in the first fraction along with the cineol.

PHELLANDRENE.

Boiling point 176° C. at 760 mm., 61° C. at 11 mm; sp. gravity at 15° C., 0·85. It forms a crystalline nitrosite ($C_{10}H_{16}N_2O_3$) with nitrous acid. The residue from distilling the oil of *E. Smithii* contains small amounts of ordinary paraffin wax, M.P. 55–56° C.

The percentage of the different constituents of Eucalyptus oil varies according to the age of the tree. Thus the oil from leaves of old trees of *E. Smithii*, whether normal or lopped, contains more cineol and less pinene than that from seedlings. The percentages also vary according to the locality.

Plate CXXI.—*Eucalyptus globulus*. THE BLUE GUM. ✓

Branch with leaves, fruits, and flowers; stamens (back and front view); stigma; bud, with double operculum.

EUCALYPTUS AND BEES.

The flowers of Eucalyptus form the main source of food for bees in Victoria, and hence the bee-keeper is interested in the times of flowering, character of the nectar and pollen, which trees are best for nectar and which for pollen, how long the flowering lasts and how often it occurs. Many Eucalypts flower at very irregular intervals, whereas bees require a constant supply of food during their working period, and hence the trees and other plants on a good bee range must be complementary to one another as regards their flowering period. Nectar may contain 60 per cent. to 90 per cent. of water, whereas honey usually contains about 20 per cent., and the concentration of the nectar varies according to the tree and to the season. Hence an abundant flow of nectar does not always give an equally abundant yield of honey.

Eucalyptus globulus, Labill. "Bluegum." (Plate CXXI.)

Description.—A tall tree attaining a maximum of 200 feet to 250 feet at about 300 years of age, with smooth, deciduous, bluish white bark. Adult foliage alternate stalked, tapering lanceolate, laminas often 6 inches to 1 foot or more long. Juvenile foliage broadly ovate and mostly stem-clasping or cordate on quadrangular stems. Flowers large, axillary, solitary or two or three together. Calyx tube broadly turbinate, thick, warty green when young, usually $\frac{1}{2}$ inch to $\frac{3}{4}$ inch diameter. The sepals form a thin outer cap, beneath which the fused petals form a thick warty operculum. Stamens over $\frac{1}{2}$ inch long, anthers ovate, opening by longitudinal pores. Fruit semi-globular, usually more or less quadrangular and $\frac{3}{4}$ inch to 1 inch diameter, sessile or nearly so, usually glaucous and often rugose or warty.

Habitat.—A native of South, North-East, and East Victoria, usually in valleys and moist declivities of wooded mountains up to the snow line; Apollo Bay, Beaufort, Beechworth, Wilson's Promontory, Neerim, Korumburra, Foster, Toora, Baw Baw, &c., and extending in patches to the Buffalo Ranges and to northern ranges in the Pyrenees near St. Arnaud. Also in Tasmania and New South Wales, but very widely planted.

Oil.—The leaves yield 0·9 per cent. of oil rich in cineol, but also containing pinene, eudesmol and sesquiterpene.

Timber.—A valuable timber tree of rapid growth. When young it will grow 7 feet to 8 feet a year in favorable circumstances, and will reach 150 feet and 4 feet girth in 30 years. Much planted in the Mediterranean regions and in California. Timber pale, straw-colour, hard, strong and durable, and can be used for keels, sleepers, bridge beams and decking, fence posts, telegraph poles, piles, &c. For furniture, flooring, cabinet work and turnery it requires careful seasoning. The ash from the burnt wood is light yellow. It is as fire-resistant as teak. A cubic foot

Plate CXXII.—*Eucalyptus Maidenii.* The Spotted Blue Gum.

A. Twig with flowers and mature leaves.
B. } Juvenile leaves.
C. }
D. Opened capsules from above.
E. Buds showing thalamus, tube and operculum.
F. Expanded flower and bud.
G. Fruits.
H. Stamens, back and front.

weighs 65 lb. to 73 lb. fresh cut, 50 lb. dry. Transverse breaking stress, air-dry wood (12 per cent. water) (3 ft. x 3 in. x 3 in.), is 8,500 lb. to 9,500 lb.; 1 ft. x 1 in. x 1 in., partly seasoned, 1,120 lb., and 1 ft. x 1 in. x 1 in., green, 65 lb., which is $\frac{5}{8}$ times the strength of oak. It grows best on carbonaceous sandstones and granite soils and with a fair rainfall. It requires a large supply of moisture, being then of rapid straight growth. It attains a circumference of 3 feet to 4 feet in fifteen years, and 5 feet to 6 feet in 50 years. It does not stand severe frost, dry, cold or desiccating winds at all well, and is sensitive to smoke. The tree is stated to form two rings of growth each year in Tasmania. The rings are not always easy to trace in Victoria.

Honey.—Dark and aromatic, but little used by bees, owing to its winter flowering (usually May-August). The flowering is annual.

Description.—*Eucalyptus globulus*, var. *St. Johni*, is a form with small, smooth fruits and a single operculum in the bud. The young seedling leaves are ovate, lanceolate, acuminate and shortly-stalked. The older seedling leaves are shortly-stalked or sessile, oval and little or not at all cordate. The leaves on adventitious shoots are similar to the juvenile leaves of *E. globulus*, as are the other characters. Baker considers this form to be a distinct species.

Habitat.—Bacchus Marsh, South and East Gippsland.

Timber.—Similar to *E. globulus*, but smaller.

Eucalyptus Maidenii, F.v.M. "Spotted Blue Gum." (Plate CXXII.)

Description.—This is sometimes known as the small-fruited Bluegum. It is a tall, straight-growing tree attaining a height of 100 feet to 150 feet, with smooth chalky-white or bluish bark, and leaves up to a foot long, narrow to broad lanceolate, curved, stalked. Juvenile leaves ovate cordate, pointed, nearly sessile, on quadrangular stems, but less stem-clasping than in Bluegum. Flowers few (two to nine), rather large, sessile on a short, much-flattened axillary peduncle. Thalamus tube usually smooth, angular or flattened, operculum short, rather flat with a blunt central point. Stamens opening by long slits. Fruit $\frac{1}{4}$ inch or more in diameter, sessile or shortly stalked, with a prominent rim and projecting valves on the rounded top.

Habitat.—A native of the East of Victoria (Upper Yarra Ranges), in Gippsland (Cassilis, Metung, Cann River), and at Bacchus Marsh and along the Lerderderg River; also in New South Wales.

Oil.—The leaves yield 1 per cent. of oil, similar to that of Bluegum, rich in cineol with pinene and sesquiterpene.

Timber.—Pale and generally similar and with similar uses to that of Bluegum. A cubic foot of commercial timber averages 54 lb. to 58 lb.

Plate CXXIII.—*Eucalyptus longifolia.* The Woolly-Butt.

Twigs, showing adult foliage, buds, flowers and fruits —

A. Juvenile foliage.
B. Anther.
C. A small fruited form.

Plate CXXIV.—*Eucalyptus botryoides*. The Mahogany Gum.

1. Upper portion of unexpanded flower, the lid lifted.
2. Longitudinal section of an unexpanded flower.
3. Stamens *in situ*.

4 and 5. Front and back view of an anther with portion of filament.

6. Top of carpel with style and stigma.

7 and 8. Longitudinal and transverse section of fruit.

9 and 10. Sterile and fertile seeds.

11. Portion of a leaf.

It is distinguished from Bluegum by the bud usually smooth, instead of warty, the peduncles long and flattened instead of shorter or none, the less sessile juvenile leaves, and the fruits with a more rounded top and more conoid shape. It usually grows on poor or steep mountain sides up to elevations of 1,000 to 3,000 feet.

Eucalyptus longifolia, Lindl. "Woolly-butt." (Plate CXXIII.)

Description.—A tree attaining a height of 100 feet to 150 feet, with a rough, dirty grey, brittle, fibrous, persistent or partially deciduous bark and a diameter of 2 feet to 5 feet. Leaves up to 6 inches long, curved lanceolate, stalked. Juvenile foliage stalked and very broadly ovate. Flowers in clusters of three, rarely four, rather large and shortly pedicillate. Thalamus tube turbinate, four to five lines long and as much in diameter. Operculum conical or bluntly pointed, thick and hard. Stamens about ½ inch long, anthers ovate-oblong, opening by longitudinal pores. Ovary depressed. Fruit large, usually in threes, rather pear-shaped to hemispherical and flat-topped, and about ¾ inch long, the valves sunk or slightly protruding.

Habitat.—A native of the East of Victoria, mainly in the eastern extremity of Gippsland, Sealers Cove, Wilson's Promontory; also in New South Wales.

Oil.—The leaves yield 0·5 per cent. of oil, rich in cineol, with sesquiterpene and a little pinene.

Timber.—Red, hard, very durable and with an interlocked grain and hence not readily fissile. Suitable for wood-paving, carriage building, fencing posts, sleepers, balustrades, curved posts, table legs and heavy cabinet work. A cubic foot of air-dry timber weighs 56 lb. to 58 lb. and 64 lb. to 68 lb. when green. Transverse breaking stress (3 ft. x 3 in. x 3 in.), 5,000 lb. to 7,500 lb. Tensile breaking stress, 20,000 lb. per sq. inch. The timber resembles an inferior red Ironbark, but the core wood is often deficient in strength or faulty and brittle.

Eucalyptus botryoides, Sm. "Mahogany Gum." (Plate CXXIV.)

Description.—A handsome tree growing to a height of 60 feet to 80 feet, with a rough, furrowed, persistent bark. Leaves 4 inches to 6 inches long, lanceolate, with divergent parallel veins, shortly stalked. Flowers rather large, four to ten together, sessile or nearly so on short peduncles. Thalamus tube ovoid turbinate, two to three lines long. Operculum from very obtuse to broadly conical. Stamens rather short, about three lines long, the anthers ovate and opening by longitudinal pores. Ovary convex on top. Fruit obovoid oblong, about eight lines long. When open and seen from above, the valves form a maltese cross.

Plate CXXV.—*Eucalyptus goniocalyx.* The Mountain Grey Gum.

Branch with buds, leaves, flowers, and fruit; bud; top of ovary showing style and stigma; stamens (back and front view); fruit from above.

Habitat.—A native of East Victoria, Snowy River, Cabbage Tree River, towards the mouth of the Brodribb River, Orbost, Lake Tyers, Lake King, Metung, usually growing near the coast; also found in New South Wales and Queensland.

Oil.—The leaves yield 0·1 per cent. consisting mainly of dextropinene with sesquiterpene and a trace of cineol.

Timber.—Hard, durable, red to reddish brown, close-grained, resembling Mahogany. The tree is frequently small, gnarled and stunted, but then yields good firewood. In sheltered places it develops to a well-balanced, straight-boled tree, and can be used for small purposes or for posts, knees, curbs, &c. The variety *saligna* of New South Wales and Queensland (*E. saligna*) is a taller tree of straighter growth and hence more valuable as a timber tree. The variety has a smooth bark, and usually grows in rich soil, in sheltered inland gullies. Near the coast it passes by gradual gradations into the type form. Suitable for heavy constructional work, sleepers, carriage building, &c. A cubic foot of air-dry timber weighs 60 lb. to 66 lb. Transverse breaking stress (3 ft. x 3 in. x 3 in.), 8,500 lb. to 10,000 lb. The ash from the burnt wood is dark greyish yellow. The wood of variety *saligna* is less dense and not quite so strong. The tree is very adaptable, is rapid in growth, and is often planted as a decorative tree as well as in forest plantations.

Eucalyptus goniocalyx, F.v.M. "Mountain Grey Gum." (Plate CXXV.)

Description.—A very tall tree attaining a height of 200 feet to 250 feet and a diameter of 2 feet to 6 feet, with the bark usually deciduous, but sometimes persistent, at least on the lower trunk, and rough. Leaves up to 12 inches or even 15 inches long. Juvenile leaves from lanceolate to broadly ovate, opposite, at first sessile, later shortly stalked. Flowers in groups of from three to seven on usually short peduncles. Thalamus tube, angular or ridged, three to four lines long, about two to three lines diameter. Operculum bluntly conical or almost acuminate, narrower and shorter than the thalamus tube. Stamens about three lines long. Anthers dehiscing by longitudinal pores. Ovary conical. Fruit angled, pear-shaped to ovoid-truncate, four lines long, shortly stalked or in an almost sessile cluster on the peduncle, the valves sunk or slightly projecting.

Habitat.—A native of South, North-east, and East Victoria and fairly widely spread. Sources of the Yarra and Barwon Rivers, Sealer's Cove, &c., Dandenong, Warrandyte, Healesville, Lilydale, Bairnsdale, Metung, Walhalla; also in New South Wales. The type form is not native to South Australia.

Oil.—The leaves yield nearly 1 per cent. of oil. It is rich in cineol, contains pinene, eudesmol, sesquiterpene and volatile aldehydes, and has a penetrating unpleasant aroma.

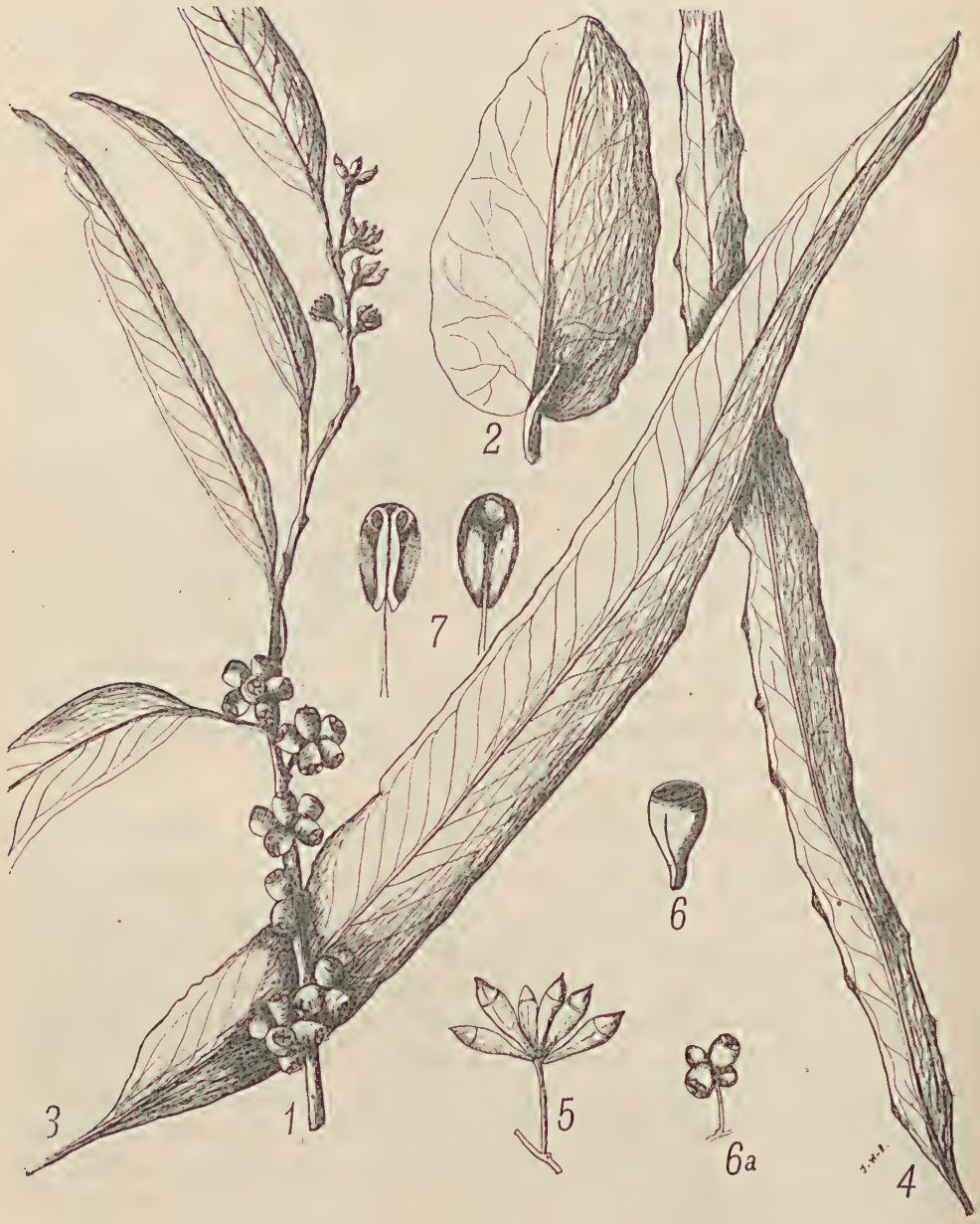

Plate CXXVI.—*Eucalyptus nitens*. The Shining Gum.

1. Twig showing buds and fruits.
2. Juvenile leaf.
3. Adult leaf.
4. Leaf showing margin with toothed appearance. ("The Critical Revision of Genus Eucalyptus," Maiden, vol. 2, parts 11 to 20, page 272.)
5. Flower buds.

6 and 6a. Fruits.

7. Stamen, back and front view.

Timber.—Pale yellow to brownish, splits well, hard, heavy and close-grained. A very valuable timber useful for beams, bridge building, furniture and general sawn timber for all constructional work above ground where strength and durability are essential. A cubic foot weighs 53 lb. to 56 lb. Transverse breaking stress (3 ft. x 3 in. x 3 in.), 8,000 lb. to 9,000 lb. The tree has a long straight bole, is of rapid growth, seeds freely and reproduces readily by natural regeneration. It grows usually on moist rich soils in gullies and hillsides up to moderate elevations. It prefers the moister cooler southern slopes of ridges to the drier northern slopes.

Eucalyptus nitens, Maiden. "Shining Gum," or "Giant Grey Gum." (Plate CXXVI.)

Description.—A tall tree reaching 200 feet to 300 feet, with a smooth bark except for a few feet at the base, or rough for the lower third of the trunk. Leaves up to 12 inches to 18 inches long. Flowers in groups of three to seven on axillary peduncles. Thalamus tube about three to four lines long, and two to three lines diameter. Operculum obtuse or shortly acuminate. Stamens all fertile, anthers oblong. Ovary conical. Fruit sessile or stalked.

Habitat.—A native of East Victoria (Baw Baws, Upper Yarra Ranges, Warburton, Gippsland, &c.); also in New South Wales.

Oil.—Similar to that of *E. goniocalyx*.

Timber.—Pinkish when fresh, but dries pale or white. Grain straight, fairly close and regular. Often apt to warp, shrink, or crack on seasoning. A tough useful mountain timber for general purposes, building construction, coach building, &c. This is possibly only a small fruited variety of *E. goniocalyx*, and it has a less durable timber.

Eucalyptus claeophora, F.v.M. "Long-leaf Box." (*E. Cambagei*, Deane and Maiden.) (Plate CXXVII.)

Description.—A medium sized tree from 40 feet to 90 feet high, with a persistent, rough, scaly, or rugose dirty grey bark, smooth on the branches. Leaves 3 inches to 7 inches long, narrow tapering. Juvenile leaves opposite, sessile, orbicular to cordate or ovate. Flowers sessile in clusters of five to seven (sessile on a short peduncle). Calyx cylindrical or angular, under two lines long. Operculum short, obtuse. Stamens short, inflexed in the bud, anthers oval, opening by longitudinal pores. Fruit sessile, almost hemispherical, three to four lines diameter, the valves usually projecting.

Habitat.—A native of South-West, South, North-East and East Victoria, on scrubby stony hills, along the sources of the Yarra, at Beaconsfield, Cassilis, Beechworth, Buffalo, Stawell, St. Arnaud, Beaufort; also in New South Wales and South Australia.

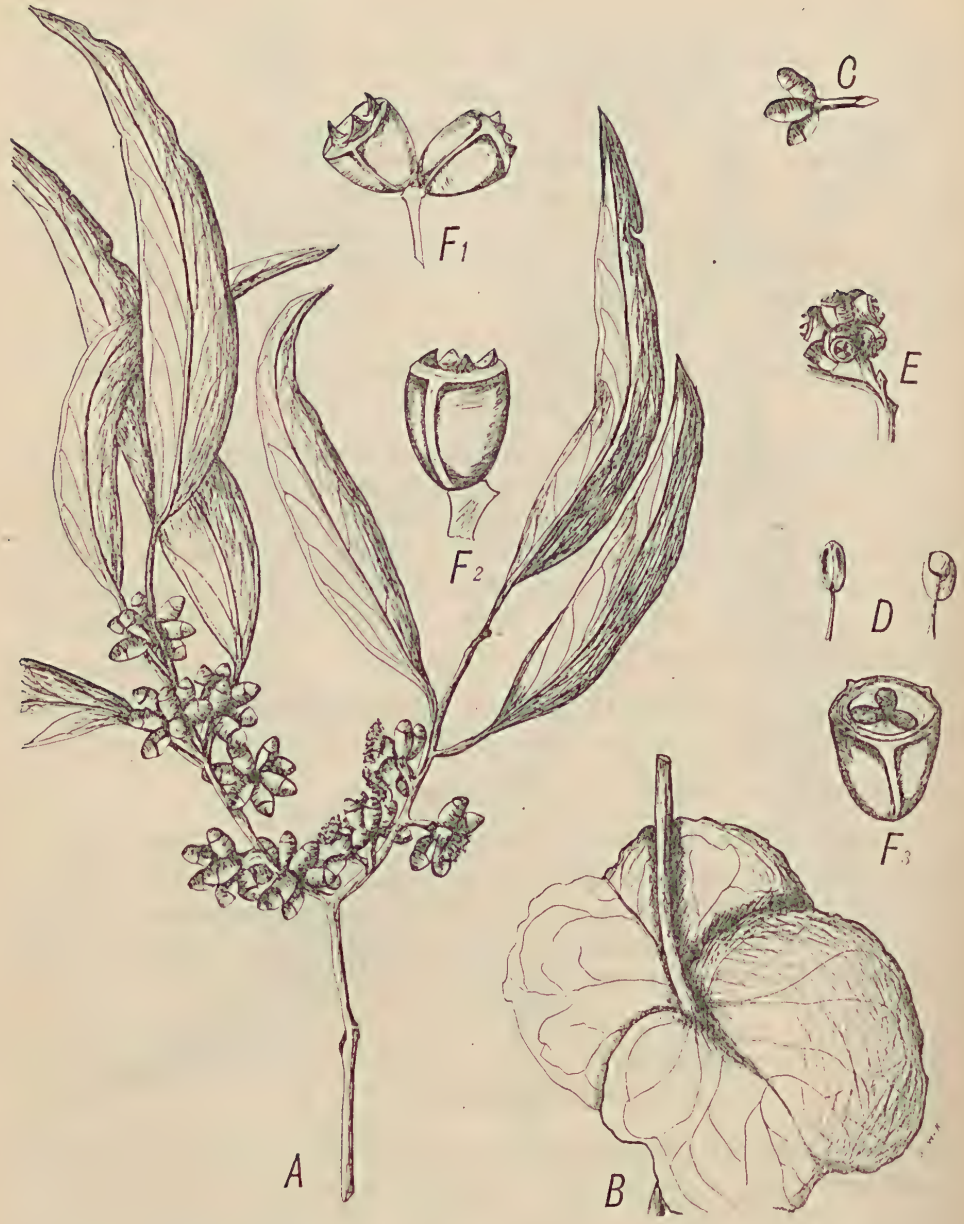

Plate CXXVII.—*Eucalyptus elaeophora.* The Long-leaf Box.

A. Small flowering twig.
B. Juvenile leaves.
C. Two-edged peduncle with buds (slightly diagrammatic).
D. Stamens, back and front view.
E. Cluster of fruits.
F. 1, 2, 3. Ripe fruits.

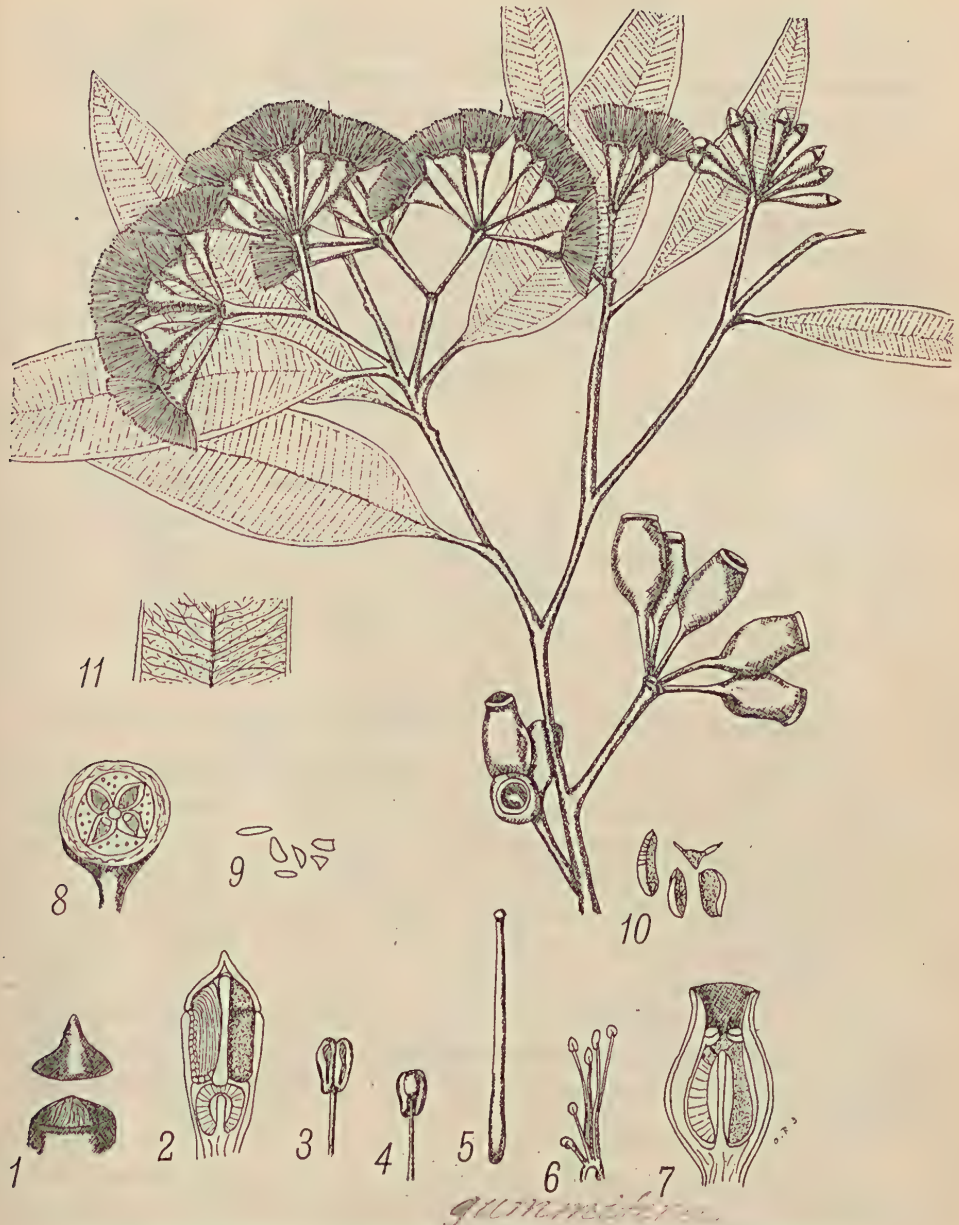

Plate CXXVIII.—*Eucalyptus corymbosa.* The Bloodwood.

1. Upper part of an unexpanded flower, the lid lifted.
2. Longitudinal section of an unexpanded flower.
3 and 4. Front and back view of an anther, with portion of its filament.
5. Style and stigma.
6. Stamens *in situ*.
7 and 8. Longitudinal and transverse section of fruit.
9 and 10. Sterile and fertile seeds.
11. Portion of a leaf.

Oil.—The leaves yield 0·7 per cent. to 0·8 per cent. of yellowish oil, rich in cineol and pinene, but with no phellandrene. It contains a little aromadendrene and eudesmol. The oil contains 50 per cent. to 60 per cent. of cineol. On keeping the crude oil the percentage of cineol increases.

Timber.—Pale, tough, hard, durable. The bole is usually short, and hence it is not of great value as a timber tree. It can be used for fencing materials and for general saw-milling where of sufficient size. It forms good fuel and for this purpose reproduces freely and rapidly from coppice. It usually grows on the side or top of hills, mainly on southern slopes, and may attain to an elevation of 2,000 feet. It stands fires well, is hard to destroy, and is often apt to replace better timber trees. It coppices freely when cut.

Honey.—Dark and of good flavour. Granulates coarsely and affords winter feed for bees. The flowering is usually biennial, and the flowers are much used for pollen, but an abundant flowering, with a rich yield of honey, usually occurs every four or five years, and sometimes for two years in succession from March to June or July.

Eucalyptus corymbosa, Smith. "Bloodwood." (Plate CXXVIII.)

Description.—Usually a small tree, but sometimes attaining a height of 50 feet to 80 feet, with rough, persistent bark. Leaves lanceolate to ovate-lanceolate, 3 inches to 6 inches long, and up to 2 inches broad. Juvenile leaves shortly stalked, opposite, orbicular-ovate, sprinkled with a few short hairs. Flowers large, on pedicels of two to four lines length. Thalamus tube broadly turbinate, three to four lines diameter. Operculum short, hemispherical, or slightly pointed. Stamens five to six lines long, the anthers very small and ovate, opening by parallel, longitudinal slits. Fruit urceolate, narrowed towards the rim, globose below, ½ inch to ¾ inch long, the valves sunk. Seeds large, ovate, often with a winglike border.

Habitat.—A native of East Victoria in Gippsland, Genoa River, Mallacoota; also in New South Wales, Queensland, and North Australia.

Oil.—Average yield small (0·06 per cent.) Contains pinene, sesquiterpene and aromadendral, with a trace of cineol.

Timber.—Red, hard, very durable in the ground, but very liable to gum streaks and gum veins. If not too prominent, these give it a rather pleasing irregular cross-grained figure of darker lines. The red kino often exudes very abundantly, and gives rise to the name bloodwood. It contains catechin and tannic acid. Useful for telegraph posts, sleepers, fence posts, wood culverts. It stands exposure to the sun without cracking, and is rarely attacked by white ants, &c. A cubic foot weighs

Plate CXXIX.—*Eucalyptus incrassata*. The Yellow Mallee.

Branches with different types of flowers, buds, and fruits.

1. Unexpanded flower, the lid lifted.
2. Longitudinal section of unexpanded flower.
3. Some stamens *in situ*.
4 and 5. Front and back view of an anther, with portion of its filament.
6. Style and stigma.
7. Longitudinal section of a fruit.
8 and 9. Transverse sections of fruits.
10 and 11. Fertile and sterile seeds.
12. Portion of a leaf.

60 lb. to 62 lb. Transverse breaking stress (3 ft. x 3 in. x 3 in.), 7,000 to 8,000 lb. The tree usually grows on poor sandstone country, up to a maximum elevation of 3,000 feet. The wood forms very good fuel.

Honey.—Rather dark and aromatic, but rarely obtained pure, Flowering usually annual, in Autumn.

Eucalyptus incrassata, Labill. "Yellow Mallee." (Plate CXXVI.)

Description.—A shrub or small tree up to 20 feet or 30 feet high, with a smooth bark and a butt enlarging at the ground level. Leaves about 4 inches long, oblong, coriaceous. Flowers in groups of three to eight, sessile or shortly pedicellate. Thalamus tube obovoid or turbinate four to five lines long. Operculum thick or rostrate, as long as the thalamus tube. Stamens often $\frac{1}{2}$ inch, anthers ovate oblong, ovary quadrilocular. Fruit ovoid-cylindrical, $\frac{1}{2}$ inch to nearly 1 inch long, the valves usually sunk.

Habitat.—A native of North-West Victoria, forming a typical component of Mallee Scrub; also in West and South Australia and New South Wales.

Oil.—The fresh leaves yield $1\frac{1}{2}$ per cent of oil, containing pinene, cineol, and aromadendral.

The insect *Spondilaspis eucalypti* often causes an excretion of manna (lerp) on the leaves and young shoots. This consists mainly of sugar, together with threads of semi-soluble starch.

Timber.—The tree has a white sap-wood and a brown heart-wood, is hard and makes good charcoal, but is not of any use for timber. The large root-stocks form valuable firewood, and their tough twisted grain gives small turned articles a striking appearance and surface. The stump coppices freely when the tree is cut down.

Honey.—Strongly aromatic but rarely obtained pure. Bees use both the nectar and pollen. The flowering is annual from March to April.

Eucalyptus incrassata, Labill., var. *dumosa*. "Dumosa Mallee." (Plate CXXIX.)

Description.—A shrub or small tree with smooth, whitish to pale greenish brown, persistent bark. Scaly at the butt, 10 feet to 15 feet or rarely up to 30 feet high and 3 inches to 8 inches diameter. There are usually several stems from one butt, hence "Whipstick Mallee." Leaves 3 inches to 4 inches long. Flowers four to eight together on axillary peduncles. Thalamus tube ovoid or almost cylindrical, two

Plate CXXX.—*Eucalyptus oleosa.* The Oil Mallee.

1. Unexpanded flower, the lid lifted.
2. Longitudinal section of an unexpanded flower.
3. Some stamens *in situ*.
4 and 5. Front and back view of an anther, with a portion of its filament.
6. Style and stigma.
7 and 8. Longitudinal and transverse section of a fruit.
9 and 10. Fertile and sterile seeds.
11. Portion of a leaf.

to three lines long. Operculum hemispherical and shorter than the thalamus tube, usually more or less ribbed. Stamens about two lines long, anthers ovate, opening by longitudinal slits. Fruit obovoid-truncate about three lines long.

Habitat.—A native of North-West of Victoria, one of the typical Mallee Scrubs ; also in South and Western Australia and in New South Wales.

It is distinguished from the type form by its more whitish bark, smaller flowers and fruits and less flattened peduncles.

Oil.—The fresh leaves yield over 1 per cent. of oil containing cineol (mainly) with pinene and aromadendral.

Timber.—Brown to pale brown in colour, stems too small to yield useful timber, but the basal irregular butts form a valuable firewood known as "Mallee Roots" ; an important soil holder in dry districts. It can usually be distinguished from the type form of *E. incrassata* by the operculum being ribbed, more obtuse and shorter, not rostrate. An indefinite series of connecting forms can be found in the Whipstick Mallee, linking the variety and the type, which otherwise could be regarded as distinct species. A variety *angulosa* with angular branchlets is recognized by some as a distinct species, *E. angulosa* Schauer (*E. costata*, R.Br.). It occurs in North-West Victoria, but is commoner in the coastal district of South Australia and Western Australia. It also passes into the type form by various gradations.

Honey.—Flowering, &c., as in the type form.

Eucalyptus oleosa, F.v.M. "Oil Mallee." (Plate CXXX.)

Description.—A shrub or small tree 10 feet to 20 feet high, bark persistent, smooth on the branches, rough on the lower part of the trunk. Leaves narrow lanceolate, stalked, 2 to 3, rarely 4 inches long. Seedling leaves opposite, very shortly stalked or almost sessile, usually broadly ovate. Flowers stalked, four to eight together on axillary peduncles. Thalamus tube obovoid, two to two and a half lines long. Operculum conical or almost acuminate, about as long as the thalamus tube, except when tapering to a point. Stamens two to three lines long, anthers ovate or almost kidney shaped, opening by longitudinal pores. Fruit ovoid or globose truncate about three lines long. Tips of the valves pointed and projecting when the fruit is ripe.

Habitat.—One of the oil-yielding Mallee Scrubs of North-West Victoria, Mildura, Euston, Swan Hill, &c. ; also in New South Wales, South Australia, and Western Australia.

Oil.—The fresh leaves yield 1 per cent. of oil, rich in cineol and also containing pinene, aromadendral and sesquiterpene.

Plate CXXXI.—*Eucalyptus cladocalyx.* The Sugar Gum.

1. Unexpanded flowers (natural size).
2. One of same, cut longitudinally.
3. } Front and back view of anther and filament.
4. }
5. Style and stigma.
6. Longitudinal section of fruit.
7. Transverse section of fruit.
8. } Sterile and fertile seeds.
9. }
10. Embryo.
12. Section of leaf.

(2 to 12 variously magnified.)

Timber.—Reddish brown to brownish red, but too small to be of any great economic value (except for fuel and as "Mallee Roots"). It is strong, tough and durable and could be used for sticks, stakes, props and turnery. Two varieties growing in Western Australia, *longicornis*, or *E. longicornis*, F.v.M. (Poot) and *glauca* (Morrel) grow to fairly large trees and yield valuable, tough, very hard and durable timber, large beams resisting fire well. In Victoria the tree is chiefly valuable for oil and as a wind-break and soil-holder in dry districts, growing well on both sandy hills and plains in the Mallee, mainly in parts close to the Murray. It coppices freely when cut.

Honey.—Strongly aromatic but rarely obtained pure. Flowering irregular, but usually annual and from Summer to Autumn.

Eucalyptus cladocalyx, F.v.M. (*E. corynocalyx*, F.v.M.) "Sugar Gum."

(Plate CXXXI.)

Description:—A tall, elegant shrub, at times a forest tree 20 feet to 40 feet high, with a basal diameter of 18 inches to 20 inches. Bark up to 1 inch thick, smooth but slightly furrowed. Leaves 3 inches to 5 inches long, lanceolate, stalked. Flowers shortly stalked in clusters of six to twelve or more on lateral peduncles. Thalamus tube narrow urceolate or almost cylindrical, three to five lines long. Operculum broad, very short or slightly pointed. Anthers very small, oval, opening by longitudinal slits. Stamens two to three lines long. Fruit more or less ribbed.

This species was first described by Mueller as *E. cladocalyx*, and later without valid reason he altered the name to "*corynocalyx*." This comes under the rule prohibiting frivolous changes of name.

Habitat.—Doubtfully native to Victoria, but very widely planted. Its native home is South Australia in the Flinders Ranges, where it attains a diameter of over 4 feet when mature, and is then used for large piles and poles.

Oil.—The leaves yield 1 per cent. of orange-brown oil containing cineol and pinene, but no phellandrene. It has no commercial value.

Honey.—Pale straw colour, clear, of medium density and good flavour. More used for nectar than for pollen. Flowering from January-February, usually annually but occasionally missing a season.

Plate CXXXII.—*Eucalyptus neglecta*. The Omeo Gum.

A. Shoot with flowers and fruits.
B. Juvenile foliage.
C. Stamen (face view).
D. Stamen (back view).
E. Section of bud.
F. Style and stigma.
G. Bud.
H. Bud with operculum lifted.
I. Transverse section of ovary.
J. Fruit.
K. Fertile seeds.
L. Sterile seeds.

Plate CXXXIII.—*Eucalyptus camphora.* The Sallow Box.

A. Branch with buds.
B and C. Showing transition of juvenile to adult leaves.
D. Cluster of fruits.
E. Single fruit.
F. Stamens, back and front.

Timber.—Pale, slightly brown at the centre, but usually poor in quality, not very large and not very durable. On limestone country, where it grows well, it appears to form timber of moderate quality, but is often of irregular growth without any long straight stem, and is readily attacked by white ants, if injured at the butt. When planted in good soils, the larger branches are very brittle and often break off in high winds. It can be used for posts, poles, bridge planking and rough purposes. Owing to its rapid growth, it is frequently planted for firewood. Stock eat the leaves readily and it has been used, not only as a wind-break, but as a fodder stand-by. It is usually of rapid growth and may reach 20 feet in four to six years, or 50 feet in eleven years, with a circumference of 41 inches, 6 feet from the ground. It does not re-establish naturally unless protected from stock and is easily killed by bush fires. When lopped it forms a dense growth of foliage.

Eucalyptus neglecta, Maiden. "Omeo Gum." (Plate CXXXII.)

Description.—A small tree 12 feet or 15 feet, rarely 20 feet high, with a smooth, greenish bark, persistent at the butt. Leaves about 3 inches long on short petioles, or nearly sessile, broadly lanceolate to almost orbicular. Juvenile leaves opposite, sessile and ovate to cordate and stem-clasping. Operculum usually slightly conical. Anthers oval, opening by longitudinal slits. Fruits nearly hemispherical, small, about $\frac{3}{16}$ inch in diameter, from three to eight or nine, in practically sessile clusters.

Habitat.—Only recorded from swampy flats at the source of the Livingstone Creek, Gippsland, at an elevation of about 3,000 feet.

Timber.—Of no economic value, rarely more than 6 inches in diameter and of crooked or almost shrubby growth. It is possible that this plant may be a local form of *E. camphora*. It is also very closely related to *E. Kitsoniana*.

Eucalyptus camphora, R. T. Baker. "Sallow Box." (Plate CXXXIII.)

Description.—A small tree 20 feet to 40 feet high with a black decorticating bark, greyish and smooth on the branches. Leaves under 4 inches long, ovate to almost lanceolate-acuminate. Juvenile leaves orbiculate to ovate, mostly opposite, stalked to sessile. Flowers five or six together, shortly pedicellate or sessile on axillary peduncles. Thalamus tube turbinate, one line long, one line broad. Operculum acuminate, about two lines long. Anthers parallel, opening by longitudinal slits. Fruit small turbinate, three lines long, two lines in diameter, the valves projecting, the rim flat or slightly domed.

Habitat.—A native of North-East, and East Victoria (Buffalo Ranges, Fern Tree Gully, Goulburn, Omeo, Mount Hotham, Dargo, Bright, Beechworth); also in New South Wales.

Plate CXXXIV.—*Eucalyptus Gunnii.* The Cider Gum.

1. An unexpanded flower, its lid lifted.
2. Longitudinal section of the same.
3. Some stamens *in situ.*
4, 5 and 6. Back, side and front view of an anther, with portion of its filament.
7. Style with stigma.
8. Longitudinal sections of fruit.
9. Transverse sections of fruit.
10 and 11. Fertile and sterile seeds.
12. Portion of a leaf.
13. Juvenile leaves.

Oil.—The leaves yield 1·3 per cent. It is rich in cineol and contains some pinene, eudesmol and volatile aldehydes.

Timber.—Pale, usually small. Poor in quality, of gnarled or twisted growth and usually on wet or swampy ground.

Mr. Maiden considered this species to be a variety of *E. ovata*, to to which it certainly seems to be very closely allied.

Eucalyptus Gunnii, Hook.f. "Cider Gum." (Plate CXXXIV.)

Description.—A small often scrubby tree, usually 20 feet to 30 feet high, smooth-barked or with reddish-brown flakes. Leaves 2 inches to 3 inches long, linear-lanceolate to oblong or even ovate. Juvenile leaves orbicular to ovate, opposite, sessile or shortly-stalked. Flowers sessile in threes or fewer, on axillary, rarely lateral, peduncles, sessile or very shortly-stalked. Thalamus tube turbinate two to three lines long. Operculum hemispherical or with a short point much shorter than the thalamus tube. Stamens two to three lines long, bright yellow. Anthers ovate. Fruit turbinate, two to four lines diameter, the valves hardly protruding.

Habitat.—A native of North-East Victoria on Mount Feathertop, Mount Hotham, Baw Baw Mountains; also in Tasmania and New South Wales.

Oil.—The leaves yield 0.4 per cent to 0.8 per cent., containing about 20 per cent. of cineol, with pinene, phellandrene and sesquiterpene.

Timber.—Too small to be of economic value. The tree is an alpine one, growing at elevations of 2,000 feet to 5,000 feet and can stand severe cold. It is an important agent in checking mountain-top erosion and in arresting floods after heavy rain. In spring, incisions in the wood yield an abundance of sugary sap which can be fermented into a weak cider. The leaves are eaten readily by cattle.

Eucalyptus Perriniana, Rodway. "Dargo Gum." (Plate CXXXV.)

Description.—A shrub or small tree 15 feet to 30 feet high with a white gum bark. Juvenile leaves perfoliate, when adult more auriculate to amplexicaul. Flowers sessile or on short pedicels, usually in threes, on axillary peduncles, yellow to orange-red. Thalamus tube two to three lines long, two lines diameter and longer than the operculum, bell-shaped. Operculum shortly conical or hemispherical. Stamens all fertile, anthers parallel, opening by longitudinal pores. Fruits nearly hemispherical or obovate cylindrical.

Habitat.—A native of East Victoria, in Gippsland and on the Dargo high plains; also in Tasmania and New South Wales.

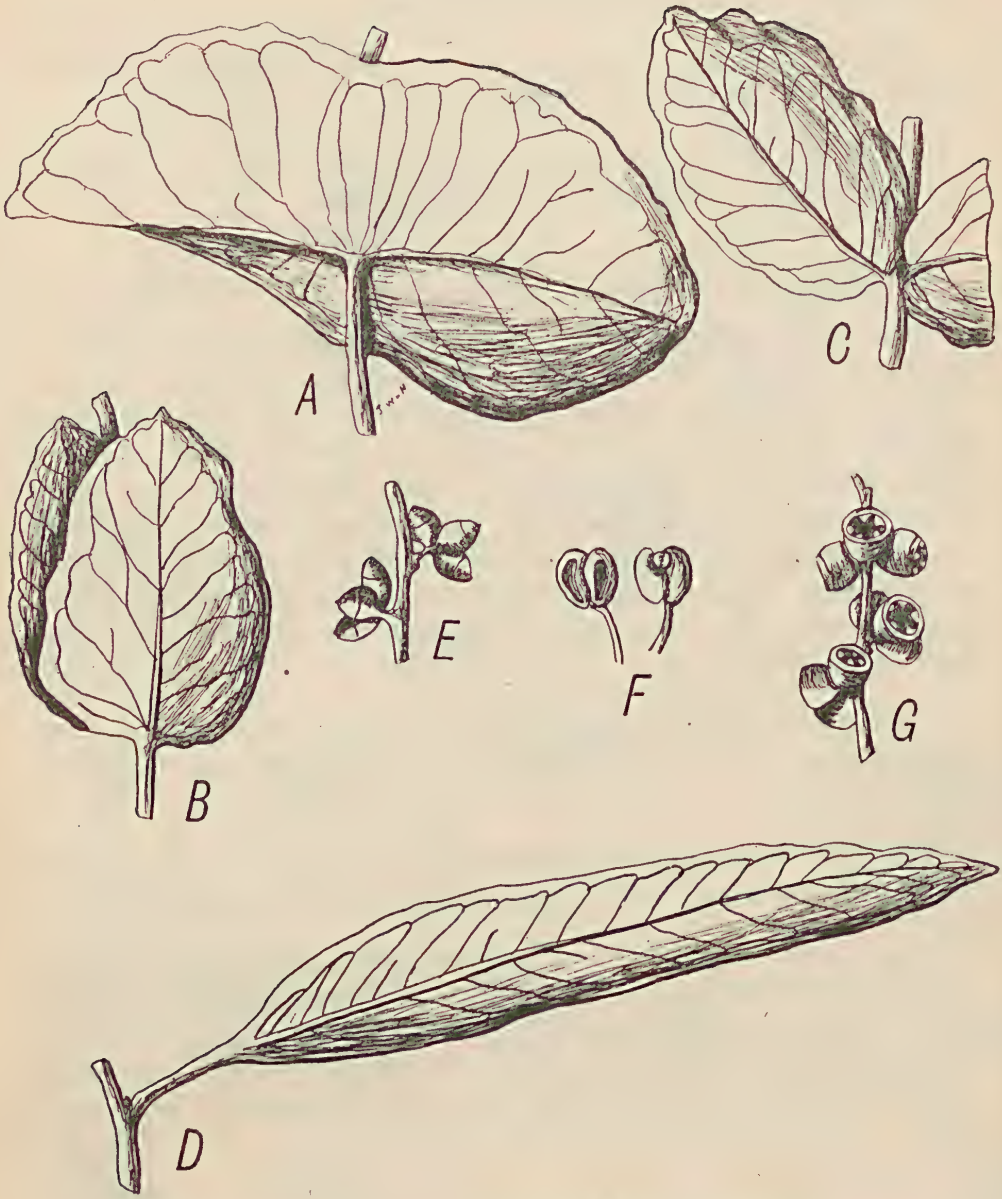

Plate CXXXV.—*Eucalyptus Perrineana.* The Dargo Gum.

A. Juvenile leaves in the perfoliate stage.
B. Juvenile leaves just united at the base.
C. Juvenile leaves free, yet still opposite.
D. Mature leaf.
E. Buds.
F. Front and back views of anthers.
G. Fruits, nearly hemispherical in shape.

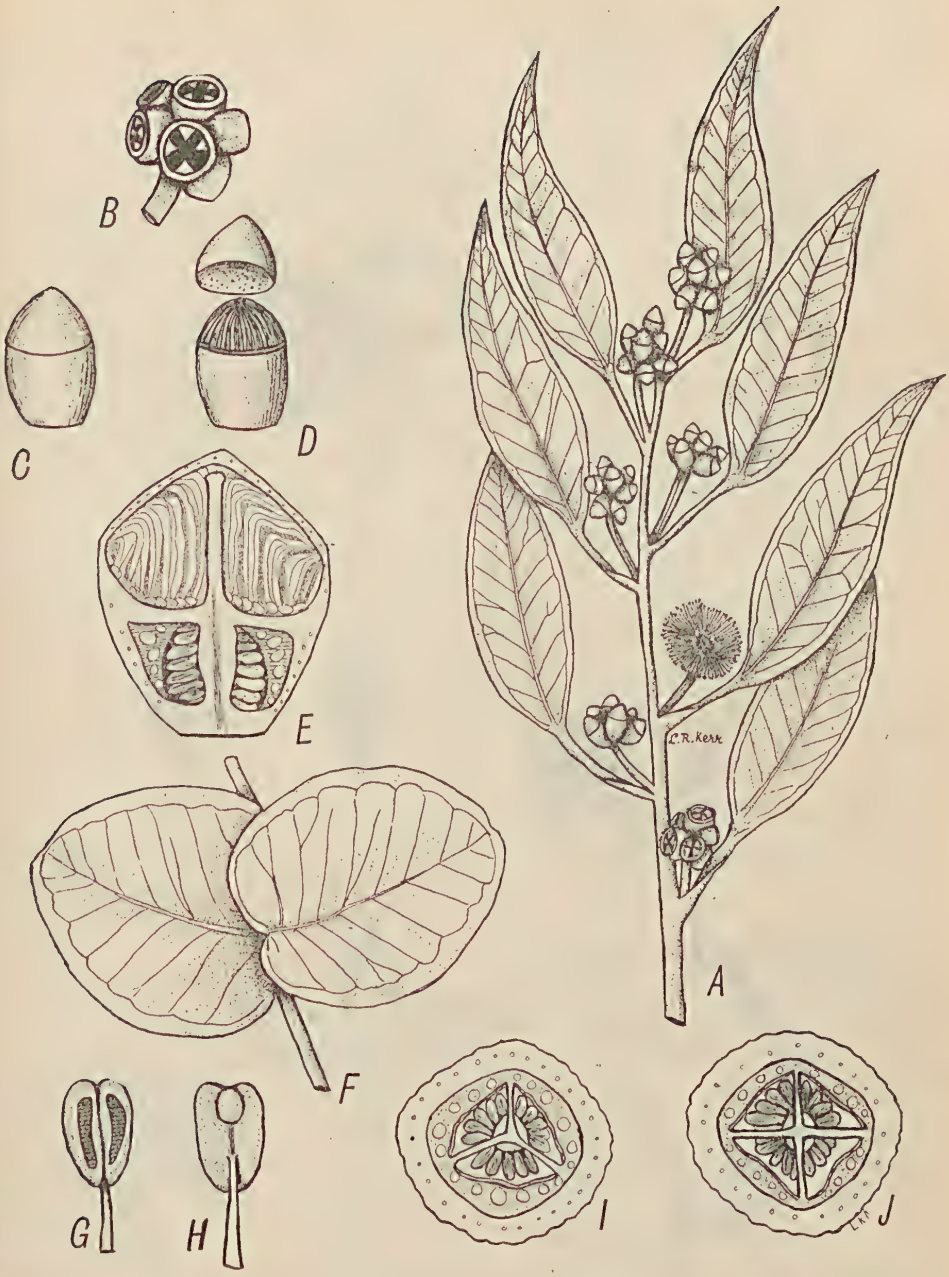

Plate CXXXVI.—*Eucalyptus Kitsoniana.* The Gippsland Mallee.

A. Branch with leaves, buds, flowers, and fruit.
B. Fruit dehiscing.
C. Bud.
D. Bud with operculum lifted.
E. Section of bud showing oil canals and glands.
F. Juvenile leaves.
G. Stamen (face view).
H. Stamen (back view).
I. Section ovary, three celled. } Both showing oil glands in the
J. Section ovary, four celled. } thalamus tube and ovary wall.

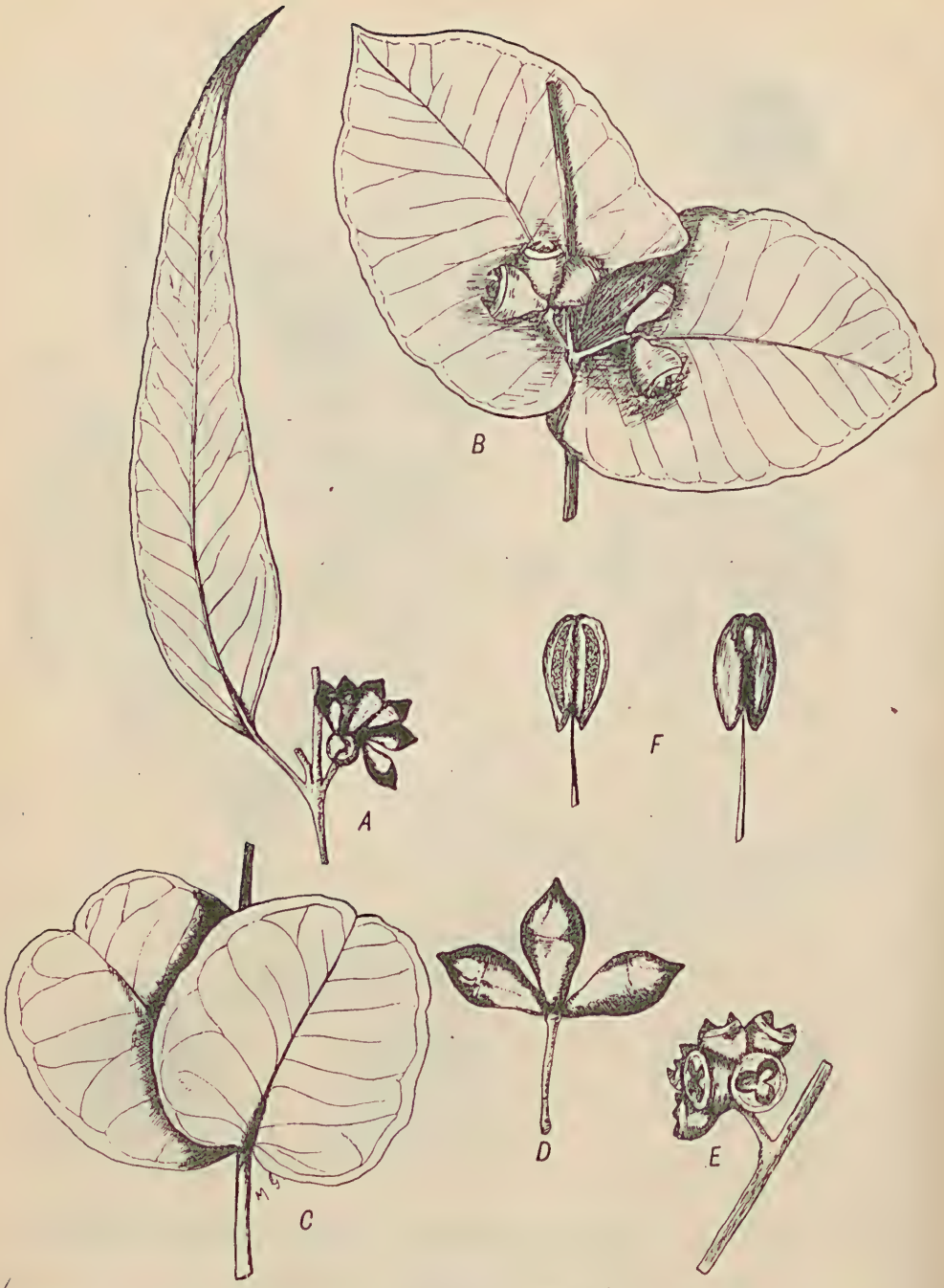

Plate CXXXVII.—*Eucalyptus cinerea.* The Mealy Stringybark.

A. Buds with ordinary adult leaf.
B. Fruits with "semi-adult" foliage.
C. Juvenile type of foliage, also occurring on adult shoots.
D. Flower buds.
E. Fruits.
A and E are of the multiflora type; B and D of the ordinary form.

Oil.—The leaves yield 1 per cent. of reddish oil, containing about 60 per cent. of cineol, much pinene and having an unpleasant aroma due to volatile aldehydes.

Timber.—Pale, too small to be of economic value, but the tree is alpine in habit, growing up to elevations of 5,000 feet, and is useful in arresting water erosion, snow avalanches and land-slips. The tree may possibly be a variety of *E. Gunnii*.

BOTANIC & DOMAIN GARDENS

Eucalyptus Kitsoniana, Maiden. "Gippsland Mallee." (Plate CXXXVI.)

Description.—A dwarf tree 5 feet to 20 feet high, with smooth, pale to ash-grey bark. Leaves up to 4 inches long by ½ inch broad on short stalks. Juvenile leaves oblong to broadly lanceolate, opposite, sessile or very shortly stalked. Flowers three to seven together, sessile on a broad short peduncle. Buds with a blunt conoid operculum. Anthers two-celled, parallel and opening by longitudinal slits. Fruit hemispherical to sub-cylindrical in shape or compressed in the cluster and over ¼ inch in diameter, with conspicuous oil glands in the ovary wall when young. Valves sunk or tips slightly projecting.

Habitat.—A native of Southern Victoria, Foster, Powlett, Cape Patterson.

Timber.—Too small to be of economic value. It usually grows in boggy land and may not be more than 5 feet to 6 feet high, but on better drained hills near Foster it may reach 20 feet.

Eucalyptus cinerea, F.v.M. "Mealy Stringybark." (Plate CXXXVII.)

Description.—A moderate-sized tree 30 feet to 50 feet, rarely 60 feet, high, with a whitish or reddish-brown fibrous persistent bark, smooth and white on the smaller branches. Leaves greyish-green, 2 inches to 4 inches long, from cordate or ovate to lanceolate, sessile in opposite pairs or shortly-stalked. Young foliage and shoots silvery grey. Flowers with short pedicels or almost sessile (in clusters of three to seven), on axillary peduncles. Thalamus tube broadly turbinate, about two lines diameter. Operculum conical, shorter than the calyx tube. Stamens two to three lines long, anthers small but ovate, opening by longitudinal pores. Fruit semi-globose, three lines diameter, the valves projecting.

Habitat.—A native of North-East and East Victoria (Gippsland, Beechworth). Growing abundantly along the road to Buchan, Lake Omeo, Walhalla, between the Avon and Mitchell Rivers; also in New South Wales.

Oil.—The leaves yield 1.3 per cent. of oil, containing cineol with a variable amount of pinene, together with esters, terpenes, and volatile aldehydes.

E cephalocarpa.

Plate CXXXVIII.—*Eucalyptus cinerea* var. *multiflora*. The Silver Stringy Bark.

A. Branch showing leaves, buds, flowers, and fruits.
B. Branch with juvenile leaves showing precocious flowering.
C. Juvenile leaves.
D. Opening flower bud.
E. Flower bud in section.
F. Transverse section of young ovary and adherent thalamus tube.
G. Anther, back view.
H. Anther, face view.

Honey.—Not of high quality, and the pollen is little used. The flowering is annual or biennial from October to December.

Timber.—Reddish and not very durable, also rarely of large size. A second-grade timber tree, useful for firewood and rough general uses, but hardly worth planting. It grows, however, on poor ground, silurian shales, &c., on flats, along watercourses and on hillsides to an elevation of 1,000 feet to 2,000 feet, usually in localities useless for agriculture. The tree maintains itself under very adverse conditions and resists fire well.

cephalocarpa Blakely

Syn. *Eucalyptus cinerea*, F.v.M., var. *multiflora*. "Silver Stringybark." (Plate CXXXVIII.)

Description.—A picturesque tree 40 feet to 80 feet high. Leaves 2 inches to 4 inches long. Flowers sessile in clusters of usually more than three on axillary peduncles. Thalamus tube obconical, two to three lines long. Operculum hemispherical. Stamens all fertile. Fruit hemispherical, two to three lines diameter.

Habitat.—A native of East Victoria, growing abundantly near Yarra Junction. The ordinary form of *E. cinerea* has usually three flowers in the umbel. The variety *multiflora* has an umbel with usually more than three flowers. Its young leaves have usually a whitish silvery bloom and hence the name "Silver-leaved Stringybark" or "Silver Stringybark." It is also found at Bairnsdale (Mount Lookout), Buchan, between Sale and Port Albert, Lilydale and Healesville, Oakleigh, Moe, Croydon, Boolara, Bunyip. It is a taller tree (up to 80 feet), has a denser, harder and more durable mahogany-like timber, and is more valuable as a timber tree. It usually grows on flats or swampy ground and is the common form in Victoria. The type form of *cinerea* is mainly restricted to Beechworth in Victoria. Various intermediates exist between the variety and the species.

Timber.—Wood very difficultly inflammable and burns with no afterglow. A cubic foot weighs 65 lb. to 70 lb. when air-dry.

Honey.—Dark but of fairly good flavour, granulates coarsely, but not hard. Useful for building up winter feed for the hive. The flowering is biennial from March to May or even June.

Eucalyptus maculata, Hooker. "Spotted Gum." (Plate CXXXIX.)

Description.—A tall tree 100 feet to 150 feet high and 4 feet to 6 feet diameter, with a smooth whitish to reddish grey bark falling off in patches, leaving bluish-white to reddish-brown marks. Leaves 4 inches to 6 inches long, lanceolate, stalked. Juvenile leaves broadly lanceolate, often very large, opposite, sessile. Flowers in umbels of three on short leafless branches forming a panicle or corymb. Pedicels short. Thalamus

Plate CXXXIX.—*Eucalyptus maculata.* The Spotted Gum.

1. Flower with unexpanded stamens, the inner and outer lids lifted.
2. Longitudinal section of unexpanded flower.
3. Some stamens *in situ*.
4 and 5. Back and front view of a stamen.
6. Style and stigma.
7 and 8. Longitudinal and transverse sections of a fruit.
9 and 10. Fertile and sterile seeds.
11. Portion of a leaf.

tube cylindrical, three to four lines diameter. Operculum hemispherical, but slightly pointed, shorter than the thalamus tube and usually with a thin, flat inner operculum. Stamens four to five lines long, all fertile; anthers ovate, opening by longitudinal slits. Fruit ovoid-urceolate, ½ inch long, with a narrow rim and a deeply-sunk capsule.

Habitat.—A native of East Victoria, in Gippsland. Also in New South Wales and Queensland.

Oil.—The leaves yield over 0.2 per cent, containing mainly pinene with cineol and sesquiterpene.

Timber.—Sap-wood pale, often rather large in amount and of little use. Heart-wood brown to yellowish brown, hard, with a fairly open somewhat wavy grain. Useful for axe and pick handles, house, ship and coach building (poles, shafts and wheel spokes), paving blocks, deck planking and fence posts; also for cabinet work and parquetry. It somewhat resembles English Oak. A cubic foot weighs 55 lb. to 56 lb. when dry, 60 lb. when air-dry and 67 lb. when green. Transverse breaking stress (3 ft. x 3 in. x 3 in.), 7,000 lb. to 9,000 lb. The kino contains catechin and 10 per cent. of tannic acid. The sap-wood perishes readily, and is attacked by beetles and white ants. Hence the tree is unsuited for telegraph posts or piles. It will attain a height of 40 feet and a diameter of a foot in 10 to 15 years, and 50 feet to 60 feet and a diameter of 2 feet in 23 years.

The Lemon Scented Gum (*E. citriodora*, Hook.) of Queensland is generally considered to be a variety of *E. maculata* (*E. maculata*, var. *citriodora*), the young foliage of which is often lemon-scented. The oil of *E. citriodora* contains citronellal ($C_{10}H_{18}O$) and esters. The slender, smooth, white stem and scented foliage render this tree easily identified when planted, as it often is in Victoria.

In "The Forest Flora of New South Wales," p. 155, it is quoted as possibly containing caoutchouc, because of the threads which draw out from the veins of the leaf when it is broken and the pieces slowly drawn apart. These are, however, merely the spiral threads pulled out from the interior of the wood vessels in the veins. Caoutchouc or mucilage threads are not necessarily associated with the veins, they are straight instead of being spirally coiled, and are often nodulated or tapering instead of being of constant thickness along their length. The difference is easily seen by comparing the mucilage threads from a broken cactus stem with the spiral threads from a Pelargonium leaf. In some cases (*E. calophylla*, *E. citriodora*), the wax excreted on the upper surface of the leaves is at first ductile and elastic, so that, if the very young leaf is broken, the two halves remain connected by a colourless membrane capable of stretching. This is not caoutchouc, as supposed by Baker and Smith, but merely plastic wax which soon hardens on exposure to the air when torn from the leaf.

Plate CXL.—*Eucalyptus ovata.* The Swamp Gum.

1 and 2. Leaf and buds of type specimen.
3*a* and 3*b*. Adult leaf; 3*c*, fruits.
4*a*. Juvenile leaf; 4*b*, back and front of anther; 4*c*, fruits.
5*a*, 5*b*, 5*c*, 5*d*. Leaf, buds, flowers, and fruit.
6. Fruits.
7*a*, 7*b*, 7*c*. Leaf, buds, and fruits.
8*a*, 8*b*, 8*c*. Leaf, buds, and fruits.
9*a*. Juvenile and 9*b*, adult leaves; 9*c*, fruits.

Eucalyptus ovata, Lab. (*E. paludosa*, R.T.B.) "Swamp Gum." (Plate CXL.)

Description.—A fairly tall tree 80 feet to 120 feet high with smooth bark, sometimes dark and furrowed at the butt, peeling in ribbons above. Leaves 3 inches to 8 inches long, and narrow lanceolate or shorter and ovate pointed. Juvenile leaves orbicular to ovate or lanceolate acuminate, shortly-stalked or sessile, opposite. Flowers seven to ten together on axillary peduncles. Thalamus tube three lines long. Operculum blunt or conical or shortly rostrate, much shorter than the thalamus tube. Stamens inflexed in the bud. Anthers oblong. Ovary half the length of the bud. Fruit sessile or shortly-stalked, conical to hemispherical, three to four celled and the valves sunk or the tips slightly projecting.

Habitat.—A native of North-West, South-West, South, and North-East and East of Victoria, widely distributed—Lake Tyers, Sale, Stratford, Traralgon, Mount Juliet, Dandenong, Otways, Macedon, Ballarat, Pakenham, Cheltenham, Oakleigh, Tarwin, Warrandyte. Also in New South Wales, South Australia and Tasmania. In the last State it attains a considerable size (over 60 feet circumference) and height over 200 feet. A small form from the Yarra, near Healesville, with a rough bark throughout, smaller leaves, flowers and fruits, has been distinguished by Maiden and Cambage as a species, *E. Yarraensis*.

Oil.—Yield 0.2 per cent. to 0.25 per cent. containing pinene, sesquiterpene and some cineol.

Timber.—Pale to reddish, moderately hard, durable and close-grained when of slow growth, but usually soft. Usually twisted in the grain and not splitting well, but can be used for posts, rough furniture, &c. When soft and free-grained, it might prove useful for match-making and wood pulp. It usually grows in moist situations and may grow to 150 feet or 200 feet, but where exposed to wind and on shallow soil, it may be merely a shrub of ten feet to 20 feet. The tree stands moist cold well and can grow at elevations of 2,000 feet to 3,000 feet. Near the coast it is always small.

Honey.—Clear amber, not dense, candies readily. Useful for both nectar and pollen. Flowering annually from March to Winter or even Spring, but usually not very profusely, sometimes missing a season.

Eucalyptus Smithii, R. T. Baker. "Gully Gum." (Plate CXLI.)

Description.—A tall tree 100 feet to 150 feet, with a diameter of 2 feet to 5 feet, usually smooth barked, except at the butt, where it is rough, thick and deeply-furrowed; above, the bark peels in long strips. Leaves 5 inches to 6 inches long. Juvenile leaves opposite, sessile, narrow, broader at the base and shortly-stalked. Flowers abundant three to

Plate CXLI.—*Eucalyptus Smithii.* The Gully Gum.

1. Juvenile leaves.
2. Branch with flower buds and adult foliage.
3. Section of bud (enlarged).
4. Anther enlarged.
5, 6 and 7. Fruits.
8 and 9. Fruits of *E. maculosa.*

Plate CXLII.—*Eucalyptus Stuartiana.* The Apple Box.

aromaphloia (except for juvenile leaves)

1. An unexpanded flower, the lid lifted.
2. Longitudinal section of an unexpanded flower.
3. Some stamens *in situ.*
4 and 5. Front and back view of anther with portion of filament.
6. Stigma and portion of style.
7. Longitudinal section of young fruit.
8 and 9. Transverse section of fruit.
10. Longitudinal section of fruit.
11 and 12. Fertile and sterile seeds.

fifteen together on axillary peduncles. Thalamus tube turbinate, three to four lines long, operculum hemispherical, obtusely conical or shortly acuminate. Stamens all fertile; anthers kidney-shaped. Fruit somewhat hemispherical and two to three lines diameter.

Habitat.—A native of East Victoria, in moist Gippsland gullies; also in New South Wales.

Kino.—The kino gives a turbid solution with water and contains eudesmin, but not aromadendrin, which is present in all other kino-producing Eucalypts with kidney-shaped anthers, according to Baker.

Oil.—The leaves are rich in oil yielding 1·1 per cent. to 1·3 per cent. It is very rich in cineol and also contains pinene and small amounts of volatile aldehydes, esters, aromadendrin, &c. The juvenile foliage yields up to 1·8 per cent of a similar oil. This is one of the most valuable Eucalyptus oils, easily purified with little loss.

Timber.—Pale, close-grained, hard, fairly strong, and useful for construction work, but difficult to work. A cubic foot weighs 60 lb. when seasoned. The tree is of limited range in Victoria, chiefly in the Mallacoota district, and only appears to grow well in moist or sheltered localities.

Eucalyptus Stuartiana, F.v.M. "Apple Box." (Plate CXLII.)

Description.—A tree 60 feet to 100 feet high, the smaller branches with smooth, white deciduous bark, the trunk with scaly or mealy, rough dirty grey "box" like bark outside and pinkish next to the wood. Leaves 3 inches to 6 inches long, lanceolate, stalked. Juveniles leaves sessile, stem-clasping, nearly orbicular. Thalamus tube smooth about two lines diameter. Operculum conical to bluntly pointed. Stamens dark-coloured, two to three lines long. Anthers versatile, opening by parallel longitudinal pores. Fruit almost turbinate or hemispherical, about three lines long, with a slightly domed rim and protruding valves.

Habitat.—A native of South-West, South, North-East and East Victoria in flats and moist valleys usually on good alluvial soil, if not flooded—Stratford, Dargo, Bright, Buchan, Ovens and Hume Rivers; also in New South Wales and Queensland, Tasmania and South Australia.

Oil.—The leaves yield 0·4 per cent of oil, more than half consisting of cineol with pinene and esters.

Honey.—Amber coloured, not very dense, candies somewhat. Yields both nectar and pollen and useful for building up winter feed for bees. Flowering annual from February to April.

Plate CXLIII.—*Eucalyptus Bridgesiana.* The But But.

1. }
2. } Juvenile leaves.
3. }
4. Twig with buds.
5. Bud in section (enlarged).
6. Anthers (enlarged).
7. }
8. } Fruits from side.
9. }
10. Fruit from above.

Plate CXLIV.—*Eucalyptus viminalis.* The Manna Gum.

Juvenile foliage (left); branch with buds, flowers and fruit (right).

1. Bud and operculum.
2. Longitudinal section of unexpanded flower.
3. Some of the outer stamens detached.

4 and 5. Front and back view of anther, with part of filament.

6. Style and stigma.
7. Transverse sections of two fruits.
8. Longitudinal section of a fruit.

9 and 10. Fertile and sterile seeds.

11. Portion of leaf.
12. Transverse section of wood.

Timber.—Pale, hard, non-fissile, rather weak and brittle, not durable, apt to crack badly on drying, and in general one of the least useful of our local Eucalyptus timber trees. Nevertheless it may prove useful for special purposes and is used for posts and flooring boards. It makes rather poor fuel and leaves a bluish-grey ash. The tree is often of rather a straggling habit and is of comparatively rapid growth, attaining a diameter of a foot and a height of 30 feet to 40 feet in ten years. The wood is very liable to the attacks of white ants, borers and timber-destroying fungi. Hence old trees are frequently piped. The crushed flowers smell like apples, hence the name, "Apple Gum." The tree stands frost and coppices freely when cut.

Eucalyptus Bridgesiana, R. T. Baker. "But But." (Plate CXLIII.)

Description.—A tree of 80 feet to 100 feet height, with a whitish-grey, wrinkled or scaly bark, greatly resembling that of Grey Box. Leaves 6 inches to 12 inches long, lanceolate, stalked, with numerous oil glands. Juvenile leaves opposite, ovate, cordate to acuminate, soon becoming shortly-stalked and alternate. Flowers with pedicels one to three or four lines long, in clusters of about seven on axillary flattened peduncles. Thalamus tube semi-ovate to top-shaped.

Operculum hemispherical or shortly pointed. Stamens curled inwards in the bud. Anthers oblong and parallel and opening by parallel longitudinal slits. Fruit hemispherical to slightly conical three to four lines in diameter.

Habitat.—A native of East Victoria, in Gippsland; also in New South Wales.

Oil.—The leaves yield 0·5 per cent to 0·6 per cent. of oil. It is rich in cineol and also contains pinene and sesquiterpene.

Timber.—Pale whitish-brown. Fairly hard, but not very strong or durable. It can be used for inside work and yields fairly good fuel. A cubic foot weighs 55 lb. to 57 lb. Breaking strain (3 ft. x 3 in. x 3 in.) 3,500 to 5,500 lbs.

Eucalyptus viminalis, Labill. "Manna Gum." (Plate CXLIV.)

Description.—A tree usually small, but sometimes attaining a height of 50 feet to 150 feet, and over 3 feet in diameter. The bark is rough at the butt for 1 foot to 30 feet and above that it is pale, smooth, and comes off in long ribbons. Usually an obvious "White Gum." Leaves 3 inches to 6 inches long, lanceolate sometimes opposite. Juvenile leaves narrow to broadly lanceolate or wedge-shaped, opposite, sessile, or shortly-stalked. Flowers on short pedicels in clusters of three to eight on short axillary peduncles. Thalamus tube turbinate or hemispherical, two lines in diameter, operculum conical to obtuse or even beaked and as

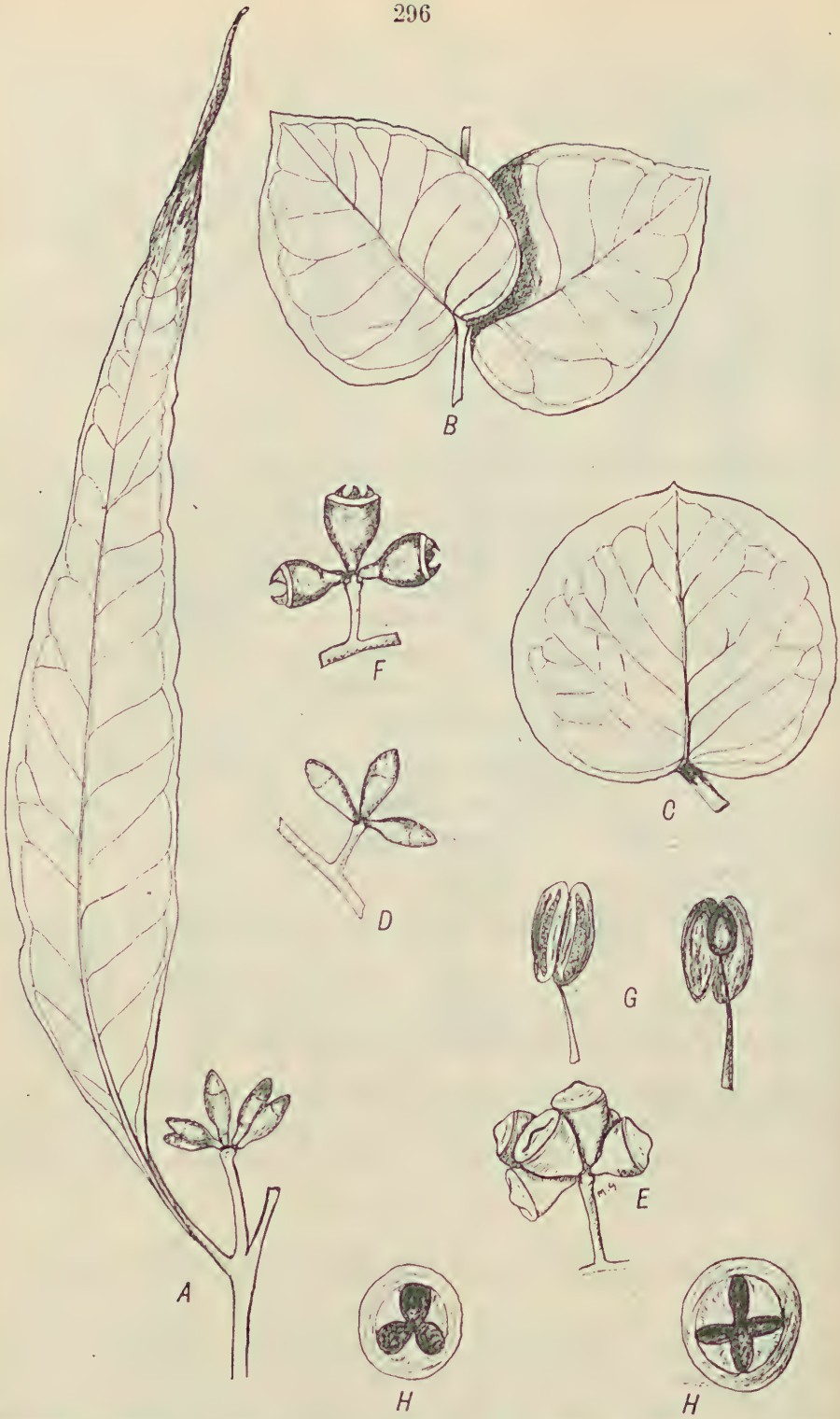

Plate CXLV.—*Eucalyptus rubida.* The Candle Bark Gum.

A. Mature leaf and buds.
B. Juvenile leaf.
C. „ „
D. Buds.
E. Unripe fruits.
F. Ripe fruits.
G. Anthers.
H. Opened capsules.

long as the thalamus tube. Stamens about three lines long, anthers ovate opening by parallel longitudinal slits. Fruit globose-truncate to nearly hemispherical three to five lines diameter, the valves protruding.

Habitat.—A native of North-West, South-West, South, North-East and East Victoria, in fertile districts on the plains as well as on the hills. Usually in cool, moist localities. Cheltenham, Barwon Heads, Wanda Vale, Portland, Port Fairy, Geelong, Bruthen, Healesville, Wilson's Promontory, Macedon, Maryborough, Castlemaine, Grampians.

Oil.—The leaves have a pleasant aroma and yield nearly 0·4 per cent. to 0·5 per cent of oil, containing cineol, pinene, phellandrene and sesquiterpene.

Honey.—Amber colour, fragrant, not very dense, candies readily. Flowers useful for both nectar and pollen. Flowering annual, but irregular, almost any month in the year and often varying on the same tree, usually from December to February. It may flower when three to five years old.

Timber.—Pale yellow, usually weak, rather brittle, apt to warp and twist and not very durable, but often cut by sawmillers and used for linings and inside work. It prefers rich moist soils on the banks of streams or lakes and there is of rapid growth, 30 feet in five to seven years, or 100 feet and 5 feet diameter in 24 years, and has a straight clean barrel up to 9 feet diameter and 150 feet high. It will also grow on poorer dry soils on hillsides, &c., where it is of slower growth and the timber is harder and more durable. A cubic foot of the harder timber weighs 48 lb. to 55 lb. when seasoned and has a transverse breaking stress (3 ft. x 3 in. x 3 in.) of 4,000 lb. to 5,000 lb. It can then be used for tool and pick handles, as well as in house building. The wood forms moderately good fuel and leaves a greyish-yellow ash. The branches often exude lerp or manna when punctured by insects. It stands moderate frost and also heat and is moderately drought-resistant. The adult forms of *E. viminalis* are often difficult to distinguish from *E. rubida*, but the seedling leaves in the former are linear-lanceolate and brightly green, and in the latter are orbicular, cordate or ovate and greyish-green.

A form of *E. viminalis* with broad sucker leaves is considered by Mr. Maiden to be a distinct species, *E. Dalrympleana*, and to grow in Gippsland as well as in New South Wales and Tasmania, often associated with *E. viminalis*. It is usually stunted and grows commonly on poor soil. Its timber is pale, inferior to *E. viminalis*, shrinks irregularly and is of low strength.

Eucalyptus rubida, Deane & Maiden. "Candle Bark Gum." (Plate CXLV.)

Description.—A moderate-sized tree 30 feet to 60 feet high, with a smooth white or pale yellow bark, with usually reddish or purple patches and sometimes with flakes or even reddish and ribbony bark. Juvenile

Plate CXLVI.—*Eucalyptus tereticornis*. The Forest Red Gum.

A.
B.
C. } Twigs with buds, flowers and fruits.

D. Unexpanded flower, lid lifted.

E. Longitudinal section of unexpanded flower.

F.
G. } Front and back view of anther with part of filament.

H. Style and stigma.

I.
J. } Longitudinal and transverse sections of fruit.

K.
L. } Fertile and sterile seeds.

leaves orbicular to ovate, sessile. Leaves 3 inches to 6 inches long, lanceolate, opposite, cornate or stem-clasping, thick, the oil dots not conspicuous. Flowers often in threes and cruciform on very short stalks or sessile on short, rounded peduncles. Operculum nearly hemispherical, shorter than the thalamus tube. Stamens all fertile; anthers ovate-oblong, opening by longitudinal pores. Fruit top-shaped to almost hemispherical, three lines in diameter, the valves projecting.

Habitat.—A native of North-East Victoria at Bright, Kilmore, the Buffalo Ranges, Dargo, Benalla, Wentworth River, Morwell, Christmas Hills, Eltham, Mooroolbark, Wandin, Healesville, &c.; also in New South Wales, Tasmania and South Australia, and even extending to Queensland. It usually grows with a single main trunk, even when growing singly, branching at the top, as in Messmate.

Oil.—Yield very small, less than 0.01 per cent., mainly of pinene, with sesquiterpene and cineol.

Honey.—Amber colour, fragrant, not very dense, candies rather readily. It flowers annually, usually in January and February, and yields pollen as well as nectar.

Timber.—Red to pale red, fairly tough and hard, with an open grain, decaying rapidly in the ground and of little general use except for fuel and rough buildings. The tree commonly exudes an abundance of white, sweet manna, which is soluble in water and is rapidly washed off by rain. It is a characteristically alpine or sub-alpine species, resistant to cold and usually found at elevations of 1,000 feet to 5,000 feet. Stock will eat the leaves freely, causing, after it has been destroyed, the commencement of alpine floods and erosion.

Eucalyptus tereticornis, Smith. "Forest Red Gum." (Plate CXLVI.)

Description.—A fairly tall tree 80 feet to 150 feet high and up to a diameter of 3 feet to 6 feet, with a smooth whitish or greyish bark shedding in thin layers. Leaves 3 inches to 6 inches long, stalked, lanceolate, tapering. Juvenile leaves ovate or lanceolate to nearly orbicular, shortly-stalked, mostly opposite. Flowers on pedicels of one to three lines in pedunculate clusters of four to eight flowers. Thalamus tube turbinate two to three lines diameter. Operculum conical to acuminate about ½ inch long, like a dunce's cap. Stamens often ½ inch long or less, anthers ovate, opening by parallel longitudinal slits, ovary nearly as long as the calyx tube. Fruit almost globular or obovoid, three to four lines diameter, the valves projecting.

Habitat.—A native of North-East and East Victoria (Snowy River, Mitchell River, Macalister River, Badger's Creek, Metung, Tambo, Stratford, Cunninghame, Bairnsdale, Briagolong, Maffra, Beechworth, Chiltern,

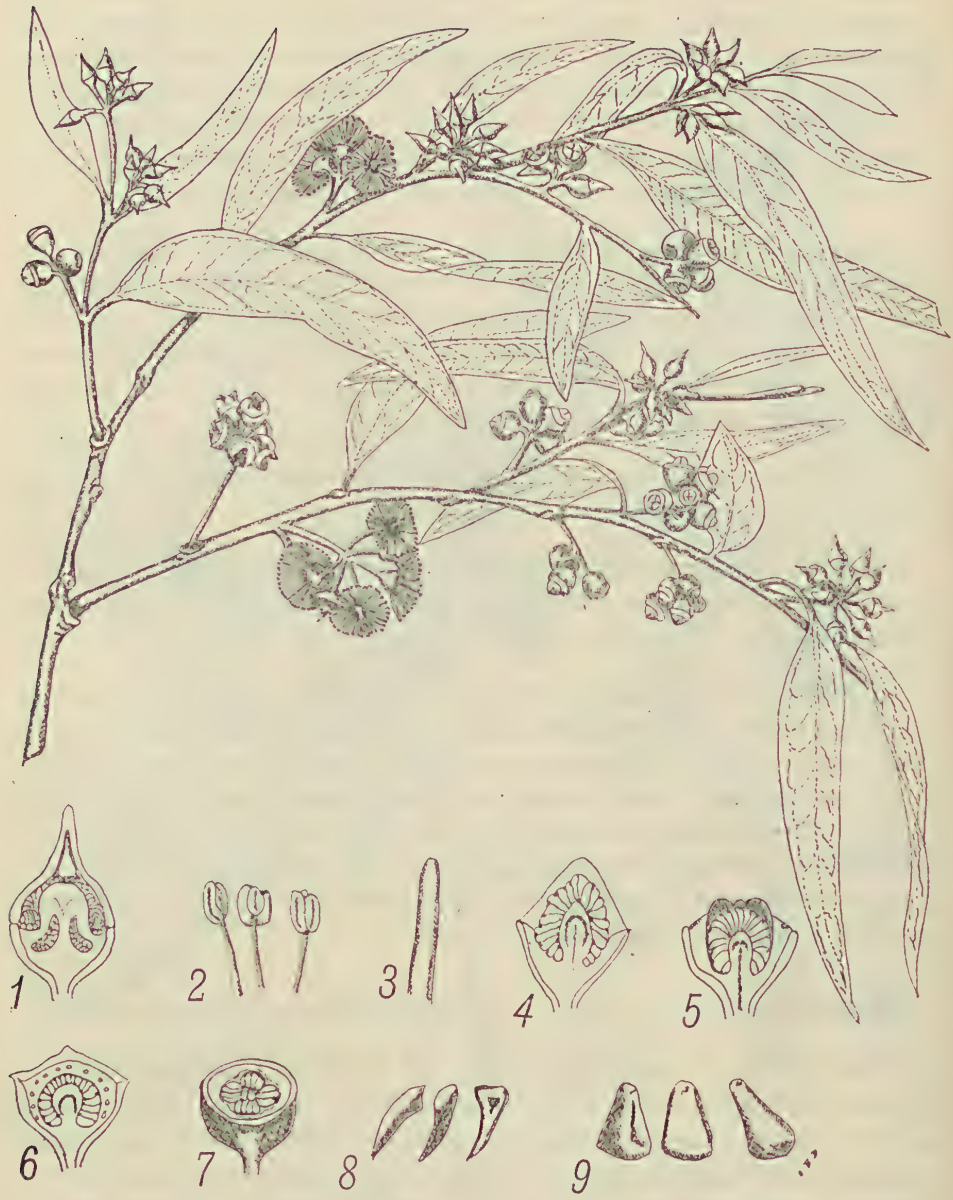

Plate CXLVII.—*Eucalyptus tereticornis* var. *rostrata*. River Red Gum.

1. Longitudinal section of unexpanded flower.
2. Side, back and front view of stamens.
3. Style and stigma.
4, 5 and 6. Longitudinal section of fruit in its various stages.
7. Transverse section of fruit.
8 and 9. Sterile and fertile seeds.

Yarram, &c.); also in New South Wales, Queensland and Papua. It grows further from rivers than *E. rostrata*, and more usually in wooded country, river flats and alluvial valleys, usually not far from the coast, whereas *E. rostrata* may form belts of timber along rivers running through otherwise treeless plains. The distinction between the two mainly lies in the operculum, and in forest plantations seed of either tree may yield mixed plantations of both forms, even though the seed was obtained from localities where hybridization seemed impossible. *E. rostrata* is botanically merely a variety of *E. tereticornis*, but there seems to be a general reluctance to suppress either species. The timber of both trees is very similar and is used for the same purposes, but that of the variety *rostrata* is perhaps more abundant, while that of *E. tereticornis* is usually equally hard and durable. Although both trees love water, they can be killed by prolonged flooding or by a pronounced permanent rise or fall in the level of the water table in the soil.

Honey.—Clear, golden, aromatic, not very dense. The flowering is biennial over large areas and takes place in December and January. The flowers are valuable for both nectar and pollen.

Oil.—The fresh leaves yield 0.4 per cent. to 0.5 per cent of reddish oil, consisting largely of aromadendral esters and containing only a small percentage of cineol and terpene, including pinene and a little cymene.

Timber.—Red, hard, tough, strong, durable. Valuable for wood blocks, sleepers, furniture and generally for sawn timber and constructional work, but often brittle and apt to split or shell off. Very durable in the ground. A cubic foot averages 60 lb. to 61 lb. when seasoned, and 45 lb. dry. Transverse breaking stress (3 ft. x 3 in. x 3 in.), 6,500 lb. to 9,000 lb.

tereticornis (rostrata)

Eucalyptus tereticornis, Sm. var. *rostrata*. "River Red Gum." (Plate CXLVII.)

Description.—A fairly tall tree up to 80 feet or 150 feet high, with a diameter of 6 feet to 10 feet and with a greyish-white bark shedding in thin leaves or flakes. Usually the main stem is short, soon splitting into stout twisted branches. Leaves 3 inches to 8 inches long, stalked, narrow, lanceolate, tapering gradually from the base to the tip. Juvenile leaves ovate or lanceolate to nearly orbicular, shortly-stalked, mostly opposite. Flowers on rather long pedicels in clusters of four to eight on short axillary peduncles. Operculum hemispherical to conical or rostrate. Stamens about two lines long. Anthers ovate, opening by parallel longitudinal slits. Fruit nearly globular, about three lines diameter, with prominently projecting valves and a domed rim, and a median equatorial line.

Plate CXLVIII.—*Eucalyptus maculosa.* The White Brittle Gum.

1. Types of adult leaf.
2. Intermediate leaves.
3. Types of juvenile leaf.
4. Flower buds.
5. Flowers.
6. Front and 7, back of anther.
8. Young and 9, ripe fruits.

Habitat.—A native of North-West, South-West, South, North-East and East Victoria from the Yarra to the Murray; usually on banks of streams, or on river flats; Heathcote, Stawell, Dimboola, Wangaratta, Yarra, Barwon, Upper Murray, Sale; also in New South Wales, Queensland, Northern Territory and Western Australia, and South Australia.

Oil.—The leaves yield 0.1 per cent to 0.4 per cent. of orange-brown oil containing aromadendral with a small amount of cineol, as well as esters and terpenes (cymene, &c.). The bark when injured exudes an abundance of kino.

Honey.—Flowering, nectar and pollen as in *E. tereticornis*.

Timber.—Red, tough, durable, with a close interlocked grain, hence not readily fissile, valuable for fence posts, sleepers, rails, uprights, as timber for greenhouses and garden edging, also furniture, paving blocks, etc. It leaves a dark cream-coloured ash when burnt. A cubic foot weighs 65 lb. green, 50 lb. to 60 lb. air-dried, and 44 lb. dry. Transverse breaking stress (3 ft. x 3 in. x 3 in.), 5,400 lb. to 7,000 lb. Tensile breaking stress 9,000 lb. per square inch. Resistant to white ants and when mature fairly resistant to teredo. The timber of *E. rostrata* is sometimes not quite so good as that of *E. tereticornis*, but this is merely because the latter usually grows in slightly drier situations than the former, so that its timber is of slower growth. When the situations are reversed the slight differences in the timbers are reversed. The variety *rostrata* can only be distinguished from *E. tereticornis* by its usually shorter operculum and even this character may vary. Slight differences in the foliage, size of fruits, &c., are not constant and are merely due to the habitat. Both trees can stand moderate frosts, much heat and a considerable amount of drought. The wood is very good and durable, and the flowers yield much honey. *E. rostrata* may attain a diameter of a foot in twelve to fifteen years. Its early growth in height is rapid (over 40 feet in ten years), but when older it is much slower.

Eucalyptus maculosa, R. T. Baker. "White Brittle Gum." (Plate CXLVIII.)

Description.—Moderately-sized tree, rarely exceeding 20 feet to 50 feet high with a smooth grey, blue or yellow spotted bark. Leaves 2 inches to 3 inches long and about nine lines width, narrow lanceolate, falcate. Juvenile leaves opposite, narrow lanceolate to ovate, shortly-stalked. Flowers pedicillate, four to twenty together on axillary peduncles. Thalamus tube turbinate about one line long. Operculum of equal length, obtuse. Stamens all fertile, anthers small, ovoid, opening by longitudinal slits. Fruit hemispherical to turbinate, about two lines broad, the valves projecting and central.

Plate CXLIX.—*Eucalyptus ~~bicolor~~ largiflorens*. The Black Box.

A. Juvenile leaves.
B. Flowering twig and immature fruits.
C. Mature fruits.

Habitat.—A native of South-West Victoria, at Mount Macedon, Woodend, Ballarat, Beechworth, Bruthen, Dargo; also in New South Wales.

Oil.—The leaves yield 1 per cent. of oil, consisting mainly of cineol and pinene with some sesquiterpene.

Timber.—Reddish, poor in quality, rather brittle, fairly hard and close-grained, and of little use except for fuel, fencing and rough buildings. It usually grows on poor ground on hillsides or in cold mountainous districts, but sometimes on flooded flats or by streams. It rarely exceeds 1 foot to 18 inches diameter. A cubic foot averages 60 lb. when seasoned.

Eucalyptus bicolor, A. Cunn. "Black Box." (Plate CXLIX.)

Description.—A large shrub or medium-sized tree, 30 feet to 40 feet high, with a diameter up to 2 feet or 3 feet, with persistent grey or dark, thick "box" bark, intermediate between an Ironbark and a Stringybark, on the lower portion of the stem, but the ends of the branches often quite smooth and white. Branches often drooping and the tree is of a spreading habit. Leaves about 3 inches to 6 inches long, $\frac{1}{2}$ inch to $1\frac{1}{2}$ inches broad, usually dull or glaucous, oblong lanceolate, acute, the oil dots small but very numerous, the tip often curved. Juvenile leaves narrow lanceolate, nearly or quite opposite, shortly stalked. Flowers red or white, small, on short pedicels about three to eight together, the clusters on short peduncles four to five lines long, and several clusters grouped in terminal panicles on a common axillary stalk. Operculum double, rather thin and hemispherical to conical. Thalamus tube hardly angular, twice as long as the lower lid of the operculum. Stamens one to two lines long, occasionally a few without anthers. Anthers of two small globular cells, opening by round or oblong pores. Fruit globular, truncate, small, about two lines diameter. Valves sunk.

Habitat.—A native of North-West Victoria, in Mallee Scrub near the Avoca, Loddon and Wimmera Rivers. Although a xerophilous species, it grows best on river flats, dry in summer, but flooded in winter. Also in South Australia, New South Wales and Queensland, and North Australia.

Oil.—The leaves yield 0.5 per cent. of oil, which is very rich in cineol and contains pinene and much sesquiterpene.

Honey.—Of good quality, dense, but rather pale in colour. Bees use the pollen. The tree flowers biennially, in January and February, for about six to eight weeks.

Timber.—Pale red to pale reddish-brown, sap-wood small in amount and pale, hard, tough, strong, very durable. Useful for sleepers, fencing, posts, carriage building, furniture and house construction. A cubic

Plate CL.—*Eucalyptus fasciculosa.* The Pink Gum.

A. Twig with buds.
B. C. } Juvenile leaves.
D. E. } Fruits.
F. Anthers.

foot weighs 60 lb. to 65 lb. A valuable timber where it can be obtained in sufficient quantity and size. The wood leaves a light yellow ash when burnt.

It is of rather slow growth, is easily killed out by fires and by grazing, and does not re-establish readily by natural regeneration. The natural supply in Victoria is limited. It is the chief hardwood on the dry northern plains for fencing and fuel. The aborigines made flour from the seeds by grinding them.

Eucalyptus fasciculosa, F.v.M. "Pink Gum." (Plate CL.)

Description.—A medium-sized tree, 30 feet to 60 feet high, sometimes smaller, with a rough persistent bark at the butt, deciduous above, leaving a pale or mottled smooth surface. Leaves leathery, 3 inches to 5 inches long, lanceolate, usually narrow without perceptible gum dots. Petiole of leaf usually twisted. Juvenile leaves large and broadly ovate, pointed. Flowers usually in clusters of three to seven, grouped in panicles and angular. Thalamus tube two to three lines diameter, somewhat angular tapering into a short pedicel. Operculum short, bluntly conical. Stamens two to three lines long; anthers with terminal pores. Fruit globular cylindrical two to four lines diameter, rather longer than broad.

Habitat.—A native of ~~North~~-West Victoria, along the Murray River, &c., but mainly existent in South Australia and in Kangaroo Island; also in Western New South Wales and Queensland.

Timber.—Dark reddish-brown, fairly hard and close-grained. It is rarely abundant and is often gnarled and stunted so as to be of little use except for fencing timber and firewood. It usually grows on dry sandy or stony ridges, and particularly near watercourses. When well grown it is used for wheels and coach-building. A cubic foot weighs 65 lb. to 67 lb.

Eucalyptus calycogona, Turcz. (*E. gracilis*, F.v.M.). "Slender Mallee." (Plate CLI.)

Description.—A tall shrub or small tree 15 feet to 25 feet high, with a silvery-grey smooth bark. Leaves about 2 inches to 3 inches long, 2 inches to 3 inches broad, linear-lanceolate, acuminate, mucronate, alternate. Juvenile leaves shortly-stalked, oblong to oblong-lanceolate. Flowers small in groups of four to eight, each flower on a very short pedicel, the umbels lateral on short stalks. Thalamus tube pyramidal, about two lines long, four-angled. Operculum hemispherical, shorter than the thalamus tube. Stamens about three lines long and flexuose; anthers kidney-shaped, opening by divergent slits. Ovary short (with four loculi). Fruit oblong or narrow urceolate, three lines long.

Plate CLI.—*Eucalyptus calycogona*. The Slender Mallee.

A. Flowering shoot.
B and D. Branches with buds.
C. Branch with ordinary fruits.
E. Small fruited form.

Habitat.—A native of North-West Victoria in the so-called desert regions of the Mallee, in the Wimmera, at Swan Hill, &c.; also in Western and South Australia.

Honey.—Both this and the variety are useful bee plants, but the flowering is irregular and the honey is rarely pure, but usually is mixed with that of other plants.

Oil.—The leaves yield 1 per cent. of orange-brown oil, half of cineol, the remainder of pinene, alcohol and sesquiterpene.

Timber.—The wood is brownish, hard, heavy and close-grained, but is usually too small to be of value except for firewood and charcoal. The form sometimes known as *E. ochrophloia* is said to attain a height of 40 feet to 50 feet.

Eucalyptus calycogona, Turcz var. *gracilis* (*E. gracilis* F.v.M.). "White Mallee."

Description.—A shrub or occasionally a tree up to 20 feet to 30 feet and 3 inches to 8 inches diameter, with smooth white or pale-brown bark, rough at the butt. Alternate coriaceous, narrow lanceolate leaves with pointed curved tips. Juvenile leaves shortly-stalked, oblong to oblong-lanceolate, opposite. Flowers in terminal or axillary stalked umbels, small, on short, slender pedicels. Operculum flattened hemispherical. Thalamus tube obconical, hardly angled, three times longer than the operculum. Fruit small, almost hemispherical or slightly urceolate, valves of the capsule nearly sunk.

Habitat.—A native of North-West Victoria (Mildura, Swan Hill and the Wimmera). Usually on sand-hills and dry foot-hills. Also in Western and South Australia.

Oil.—Fresh leaves yield 0.7 to 0.9 per cent. of brown oil, containing pinene, cineol (20 per cent.), aromadendral and volatile aldehydes.

Timber.—The timber is too small to be of much use, but forms good small firewood, is brown in colour and can be used for small posts or props, swingle-trees, &c. It is important in arresting wind denudation in dry districts, as is also the type form.

Eucalyptus calycogona, Turcz var. *celastroides*. (*E. fruticetorum*, F.v.M.)

A shrub with alternate linear-lanceolate leaves shortly acuminate. Flowers three to six in stalked umbels. Operculum depressed hemispherical, thalamus tube obconical, four-ribbed. Leaves three to three and a half lines broad. Filaments white. Fruit four-locular. A native of North-West Victoria at Mildura and the lower Avoca River: also in Western Australia.

Plate CLII.—*Eucalyptus polyanthemos.* The Red Box.

1. Longitudinal section of an unexpanded flower.
2 and 3. Front and back view of a stamen.
4. Style and stigma.
5. A portion of the calyx with fertile and sterile stamens.
6 and 7. Longitudinal and transverse sections of a fruit.
8 and 9. Sterile and fertile seeds.

Eucalyptus polyanthemos, Schauer. "Red Box." (Plate CLII.)

Description.—A moderate-sized tree 40 feet to 110 feet high, with a scaly persistent bark, smooth on the branches, or with grey or green patches and coming off in ribbons. Leaves glaucous, greyish-green, 1½ inches to 3 inches long and nearly as broad, ovate or elliptical on stalks about ¾ inch long, sometimes more lanceolate. Juvenile leaves rather large, broadly ovate or orbicular mostly on rather long stalks. Flowers in clusters of three to six in terminal or axillary panicles, leafy at least towards the base. Thalamus tube one to one and a half lines long. Operculum obtusely conical, usually with resinous spots, which are also present on the thalamus. Stamens one to two lines long. Anthers small with globular distinct cells and terminal pores. Fruit turbinate to semi-ovate, usually three lines in diameter, the valves sunk.

Habitat.—A native of North-West, South-West, South, North-East and East of Victoria, in Gippsland along the Ovens River, Euroa, Lilydale, Buchan, Heathcote, Chiltern, Havelock, Maryborough, Bendigo; also in New South Wales. It usually grows on the lower slopes or hillsides, but may attain to an elevation of 2,000 feet.

Oil.—Yield 0.88 per cent., consisting mainly of cineol with some pinene and esters.

Honey.—Very pale, dense, dull, with a slight tallowy taste, Flowers of little use for pollen. Flowering biennial, but often annual, and from September to November.

Timber.—Hard, strong, tough, durable, dark red; sap-wood pale yellow to white, a valuable timber when of sufficient size and of straight growth for fencing, sleepers, bridges and wheelwrights' work. A cubic foot weighs 65 lb. to 67 lb. It is, however, often small with crooked limbs and bole, and of a spreading habit, and is then of little use except for house-blocks, paving blocks, firewood, turnery and cabinet work. It leaves a pale greyish ash when burnt. It usually grows on hillsides up to elevations of 2,000 feet to 3,000 feet, stands cold and moderate drought fairly well, but is of slow growth and does not regenerate well unless protected from stock. It coppices fairly well and also reproduces from seedlings. In mountain valleys and narrow rich flats in North Gippsland it attains a good height and stem diameter, and is tall, straight, and of more rapid growth. It is then used for sleepers, poles, beams and fencing timber. It blooms profusely and is a valuable bee tree.

Eucalyptus Baueriana, Schauer. "Lignum Vitae Box." (Plate CLIII.)

Description.—A medium-sized tree, attaining 50 feet to 80 feet in height and 2 feet to 3 feet diameter, with a rough, dark "box" bark on the trunk and usually on the branches. Leaves dark green, 1 inch to 3 inches long and 1 inch to 2 inches broad, ovate, usually somewhat broad with a pointed tip, the stalks shorter than in "Red Box." Juvenile

Plate CLIII.—*Eucalyptus Baueriana.* The Lignum Vitae Box.

A. Juvenile leaf.
B. Flowering twig.
C. Fruits.

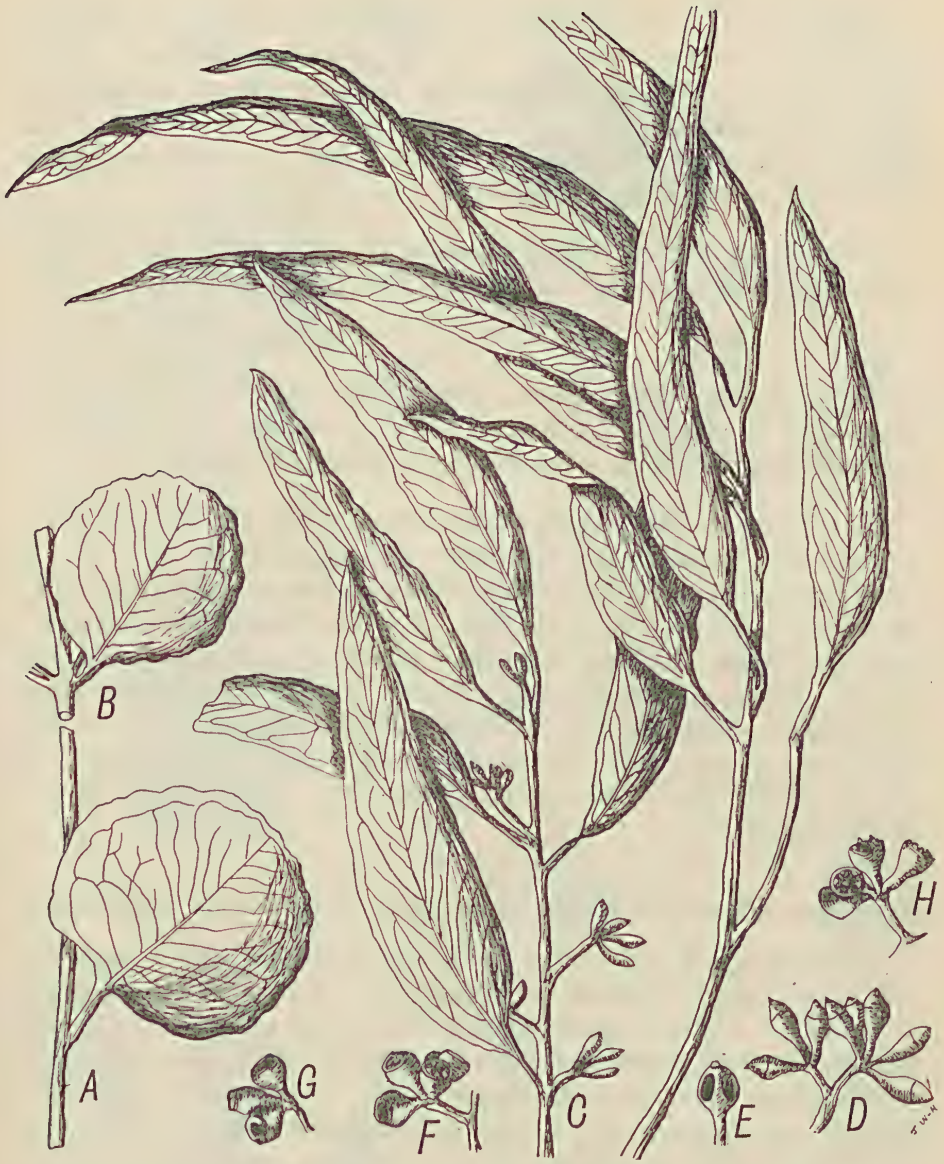

Plate CLIV.—*Eucalyptus Bosistoana*. The Gippsland Grey Box.

A and B. Juvenile leaves.
C. Flowering twig.
D. Buds.
E. Anther.
F. Fruit.
G. Unripe fruit showing rim.
H. Fruit with exserted valves.

leaves very similar to *E. polyanthemos*, broadly-lanceolate to almost orbicular, on short stalks. Flowers numerous in axillary or terminal panicles, the umbels of five to seven flowers on short peduncles two to three lines long. Thalamus tube conical, tapering to a very short pedicel Operculum conical, pointed or almost hemispherical; anthers broad and truncate with terminal pores. Fruit conical, four lines long, three lines broad, rim thin, flat, capsule sunk.

Habitat.—A native of East Victoria, in Gippsland, Metung, Nowa Nowa, Bairnsdale; also in New South Wales.

Oil.—Not known.

Honey.—Pale, clear, dense without any tallowy taste. Flowers useful for both nectar and pollen. Flowering irregular, often varying on the same tree and taking place from September to November.

Timber.—Pale brown, very hard, tough and durable, and very valuable when of sufficient size. A cubic foot weighs 65 lb. to 70 lb. It grows more on river flats and rich land and reproduces readily by coppice growth from suckers. After the first few years it appears to be of rather slow growth and does not regenerate readily by seedlings unless protected. It prefers good soil on flats or river banks, mostly near the coast, but in Queensland and New South Wales extends to elevations of over 2,000 feet. A good tree has usually a rather dense rounded head. It is sometimes known as Cabbage Box, Apple Box, Brown Box, Black Box and Fuzzy Box.

Eucalyptus Bosistoana, F.v.M. "Gippsland Grey Box." (Plate CLIV.)

Description.—A tall tree 90 feet to 160 feet high, with a symmetrically-shaped head and a white or pale-grey smooth bark, rough and fibrous at the butt. Leaves variable in shape from broad to lanceolate, usually narrow, on short stalks, the veins faint, the oil dots conspicuous, dull green on both sides. Juvenile leaves rounded or broadly ovate, shortly-stalked, opposite or nearly so and rather distant. Flowers in axillary or terminal umbels of few flowers. Peduncles shorter than the umbels. Pedicels short, thick and angular. Thalamus tube slightly angular and turbinate to semi-ovate, often more or less flattened. Operculum semi-ovate or hemispherical, often pointed, as long as the tube. All the stamens fertile. Anthers very small, rounded or cordate and opening by longitudinal pores. Fruit globular to semi-ovate, about ¼ inch in diameter, and usually with five, rarely four or six, sunk valves.

Habitat.—A native of East Victoria, in Gippsland, along the Tambo River, &c.; usually on dry, hilly ground or limestone formations, formerly abundant but now largely destroyed by ring-barking. Also in eastern New South Wales. *E. Nepeanensis*, Baker & Smith, is a form with juvenile leaves.

PLATE CLV. *Eucalyptus Behriana.* THE BULL MALLEE.

Normal form with globular truncate fruits and on left form with longer fruits and longer thalamus tubes.

1. Bud and operculum; and 2, bud in section.
3. Group of stamens; and 4 and 5, single stamens, back and front view.
6. Style and stigma.
7. Vertical and 8, transverse sections of fruit.
9. Fertile and 10, sterile seeds.
11. Portion of leaf.

Oil.—The leaves yield nearly 1 per cent. of oil containing a fair quantity of cineol, but with pinene and sesquiterpene.

Timber.—Pale, reddish or brownish-yellow, durable, close-grained, but somewhat less tough and hard than in yellow Box (*E. melliodora*), which has yellow sap-wood instead of white as in *E. Bosistoana*. The wood of the latter darkens with age after cutting, but works fairly well and is a useful timber for general purposes (building, piles, posts, sleepers), where it can be obtained in sufficient quantity and size. A cubic foot weighs 65 lb. to 70 lb. It leaves a pinkish ash when burnt, re-establishes itself well by natural regeneration when protected from fires and stock, but is actually in rapid process of extinction. It is well worthy of preservation on account of the value of its timber.

Honey.—The tree is too scarce to yield a pure source of honey. Bees use the pollen, and flowering usually occurs annually, in January or February.

Eucalyptus Behriana, F.v.M. "Bull Mallee." (Plate CLV.)

Description.—A tall shrub up to 10 feet high or a small tree of 20 feet to 30 feet, with a diameter up to 9 inches, with a smooth, dirty-white bark, or almost dark green on the younger branches. Leaves about 3 inches long, broad, thick and shiny. Juvenile leaves ovate to linear lanceolate and on short stalks. The flowers are sessile at the ends of short peduncles in few flowered umbels grouped in panicles. Buds obovoid. Thalamus tube less than two lines long. Operculum short, blunt, hemispherical, often double, the outer one membranous and persisting in advanced buds. Stamens all perfect, filaments short, less than two lines long. Anthers small, globular and opening by circular pores. Fruit dark shiny, obovoid globular and truncate, about two lines diameter. Seeds brown, streaked.

Habitat.—A native of South and North-West Victoria, at Bacchus Marsh, Avoca River, Pine Forest, Mallee, Wimmera, &c. It frequents dry localities and is resistant to drought. Also in New South Wales and South Australia.

Oil.—Yield 0.6 per cent. with much cineol and some pinene and sesquiterpene as well as esters.

Honey.—Characters and flowering as in Grey Box, *E. hemiphloia*.

Timber.—Red to reddish-brown with a close wavy interlocked fine grain, but frequently too small to be of any great value except locally for firewood or mallee stumps. When cut it coppices freely from the stools. The tree is valuable as a preventive of wind erosion in dry districts. The wood could be used for bearings, axles, &c.

Plate CLVI.—*Eucalyptus hemiphloia.* The Grey Box.

1. Bud and operculum.
2. Longitudinal section of an unexpanded flower.
3. Stamens *in situ*.
4 and 5. Front and back view of an anther with portion of filament.
6. Style and stigma.
7. Longitudinal section of fruit.
8. Transverse section of fruit.
9 and 10. Fertile and sterile seeds.
11. Portion of leaf.

Eucalyptus hemiphloia, F.v.M. "Grey Box." (Plate CLVI.)

Description.—Sometimes a shrub, but less usually a tree 60 feet to 120 feet high, with a scaly grey, almost "ironbark," densely matted and sub-fibrous, the persistent bark pale at the base and smooth on the branches. Leaves 3 inches to 5 inches long, broad to narrow, large, coarse, dull. Early seedling leaves linear lanceolate, later juvenile foliage, especially on cropped shoots, broadly ovate or almost orbicular, shortly-stalked, mostly opposite. Flowers in umbels of four to eight flowers forming terminal panicles, rarely single umbels. Thalamus tube two to two and a half lines long. Operculum double, conical acuminate, as long as the thalamus tube. Stamens pale, about two lines long. Anthers very small with nearly terminal pores and a gland. Fruit ovoid, oblong or urceolate, the valves deeply sunk, about three to four lines long, angular when young, four to six celled.

Habitat.—A native of North-West and North-East Victoria, at Beaufort, Rushworth, Murchison, Carisbrook, Loddon River, &c.; also in New South Wales, Queensland and South Australia. The type form appears to be less common in Victoria than in New South Wales and some of the above localities may refer to the varieties given below.

Oil.—The oil dots are not very conspicuous, but fresh leaves yield 0·5 to 0·6 per cent. of oil containing aromadendral, pinene, and cineol. The crude oil has rather a rank odour.

Honey.—Amber colour of medium density and excellent flavour, but candies quickly. Valuable for both nectar and pollen. Flowering is biennial but neighbouring plants flower in different years. It is very profuse and takes place from February to June according to the district. Occasionally a second flowering may occur later in the year.

Timber.—Hard, tough, very durable, pale to light brown, non-fissile, useful for general purposes, constructional work, piles, house-blocks, sleepers, beams, decking, handles, shafts, mauls, fencing materials, &c. A cubic foot weighs 75 lb. to 80 lb. fresh, 60 lb. to 65 lb. air-dry, and 50 lb. dry. Transverse breaking stress (3 ft. x 3 in. x 3in.), 8,500 lb. to 10,500 lb. Tensile breaking stress 22,000 lb. per square inch. It is a valuable fuel. The tree usually grows at low elevations, often on clayey soil or in dry districts near streams. It is easily killed out and does not re-establish itself by natural regeneration where grazing is allowed. It often becomes hollow while still comparatively young and is normally of slow growth. The kino contains eudesmin.

Eucalyptus hemiphloia, F.v.M. var. *microcarpa*. "Small-fruited Grey Box."

Description.—This is a medium to tall tree with a compact "ironbark," grey or white on the trunk and smooth on the branches. It resembles the type, except in its smaller fruits, but is now considered by Maiden to be a distinct species, mainly because of its thicker and slightly glaucous juvenile foliage.

Plate CLVII.—*Eucalyptus uncinata*. The Hooked Mallee.

1. An unexpanded flower, the lid lifted.
2. Longitudinal section of an unexpanded flower.
3. Some stamens *in situ*.
4, 5 and 6. Back, front and side view of an anther with portion of its filament.
7. Style with stigma.
8 and 9. Transverse and longitudinal section of fruit.
10 and 11. Sterile and fertile seeds.

Habitat.—It is a native of North and North-East Victoria, abundant near Bendigo, Wedderburn, Maryborough and Heathcote; also in New South Wales.

Timber.—Hard, tough, durable, pale to light brown, usually not splitting freely, but a very useful timber for general purposes. The centre core wood is apt to rot so that overmature trees become hollow. Of rather slow growth in the moderately dry districts which it favours.

Eucalpytus hemiphloia, F.v.M., var. *albens*. "White Box."

Description.—A tree attaining to a height of 60 feet to 80 feet with a dull grey or whitish persistent bark. Leaves up to 6 inches long. Flowers in clusters of four to eight on peduncles ¾ inch long. Thalamus tube three to four lines long. Stamens the same. Ovary short, conical. Fruit obovoid-oblong, nearly ½ inch long.

Habitat.—A native of South and North-East Victoria, at Violet Town, Bacchus Marsh, &c.; also in New South Wales and South Australia. This variety is more common than the type form in Victoria. It usually grows in drier localities than the type and is distinguished by its paler, duller foliage, panicles usually with a whitish bloom, stouter pedicels and larger calyces. It seeds freely and re-establishes itself readily if protected from stock.

Oil.—The leaves are poor in oil, yielding only 0.1 per cent. containing cineol, aromadendral, volatile aldehydes and pinene.

Honey.—Similar to type form but the flowering is usually a month earlier.

Timber.—Timber and other features as in the preceding forms, but it is usually a smaller tree and of slow growth. The wood is pale, hard and close-grained. A purple-flowered form in South Australia is sometimes known as variety *purpurascens*.

Eucalyptus uncinata, Turcz. "Hooked Mallee." (Plate CLVII.)

Description.—A tall shrub 10 feet to 25 feet high with a smooth ash grey or almost white bark. Leaves under 3 inches long, thick, usually with curved hook-like tips and under ¼ inch broad, shortly-stalked. Juvenile leaves, sessile, opposite broadly ovate to lanceolate, not large. Flowers small six to eight on short stout axillary peduncles, in terminal panicles. Thalamus tube, one and a half lines long with hardly any pedicel. Operculum obtusely conical, or almost pointed and longer than the thalamus tube. Stamens about two lines long, filaments sharply bent, anthers very small with terminal pores. Capsules rather pear-shaped, two to nearly three lines in diameter, in dense clusters or heads on a common stalk.

Habitat.—A native of North-West Victoria, in the Wimmera District and along the lower River Murray, Dimboola, Nhill, Inglewood, Diapur; also in South Australia, Western Australia, and New South Wales.

Plate CLVIII.—*Eucalyptus polybractea*. THE BLUE MALLEE.

A and B. Pair of juvenile leaves.
C. Branch with buds, flowers and fruits.
D. Anther.

Mr. Maiden considers that this species is confined to Western Australia.

Oil.—The leaves yield 1.4 per cent. of brown oil with 40 per cent. of cineol and also containing pinene, sesquiterpene, alcohol and aromadendral.

Honey.—Good flavour, clear, not very dense but with a slight tendency to candy; one of the best Mallee bee plants. Flowers every second year from March to May.

Timber.—Brown or somewhat reddish, but too small to be of value. The butts are used for firewood as mallee "roots." It is a characteristic Mallee Eucalypt, usually growing on dry sand hills and is of importance in checking wind erosion. It seeds freely and reproduces by suckers when cut down.

Eucalyptus polybractea, R. T. Baker. "Blue Mallee." (Plate CLVIII.)

Description.—A glaucous shrub 15 feet to 20 feet high with quadrangular branchlets. Leaves mostly 3 inches long and six lines broad. linear to linear-lanceolate, often pointed and with abundant oil dots, The juvenile leaves are opposite and oblong or broad lanceolate. Young buds angular and surrounded by small pale pointed deciduous bracts. Flowers in clusters of two to twelve on lateral peduncles, two to three lines long. Thalamus tube conical, tapering into a short pedicel. Operculum obtuse hemispherical. Stamens all fertile, anthers small, nearly globular, dehiscing by obliquely lateral almost terminal oval pores. Fruit hemispherical to pear-shaped, two lines in diameter.

Habitat.—A native of North-West Victoria, in the Mallee, at Inglewood, &c.; also in South Australia and New South Wales.

This species is considered by Mr. Maiden to be a synonym to *E. fruticetorum*, F.v.M. The latter was, however, originally a compound of at least three species and was later considered by Mueller to be the same as *E. santalifolia*. It is not now possible to attach the name *E. fruticetorum* to any distinct species.

Oil.—Not quite so abundant as in the allied *E. odorata*, but similar in character. The leaves yield 1.3 per cent. of oil, more than half of cineol, with some pinene and aromadendral but very little of volatile aldehydes and esters.

Honey.—The flowers yield both honey and pollen, but the honey is usually mixed with that of other species. Flowering usually annual, but irregular.

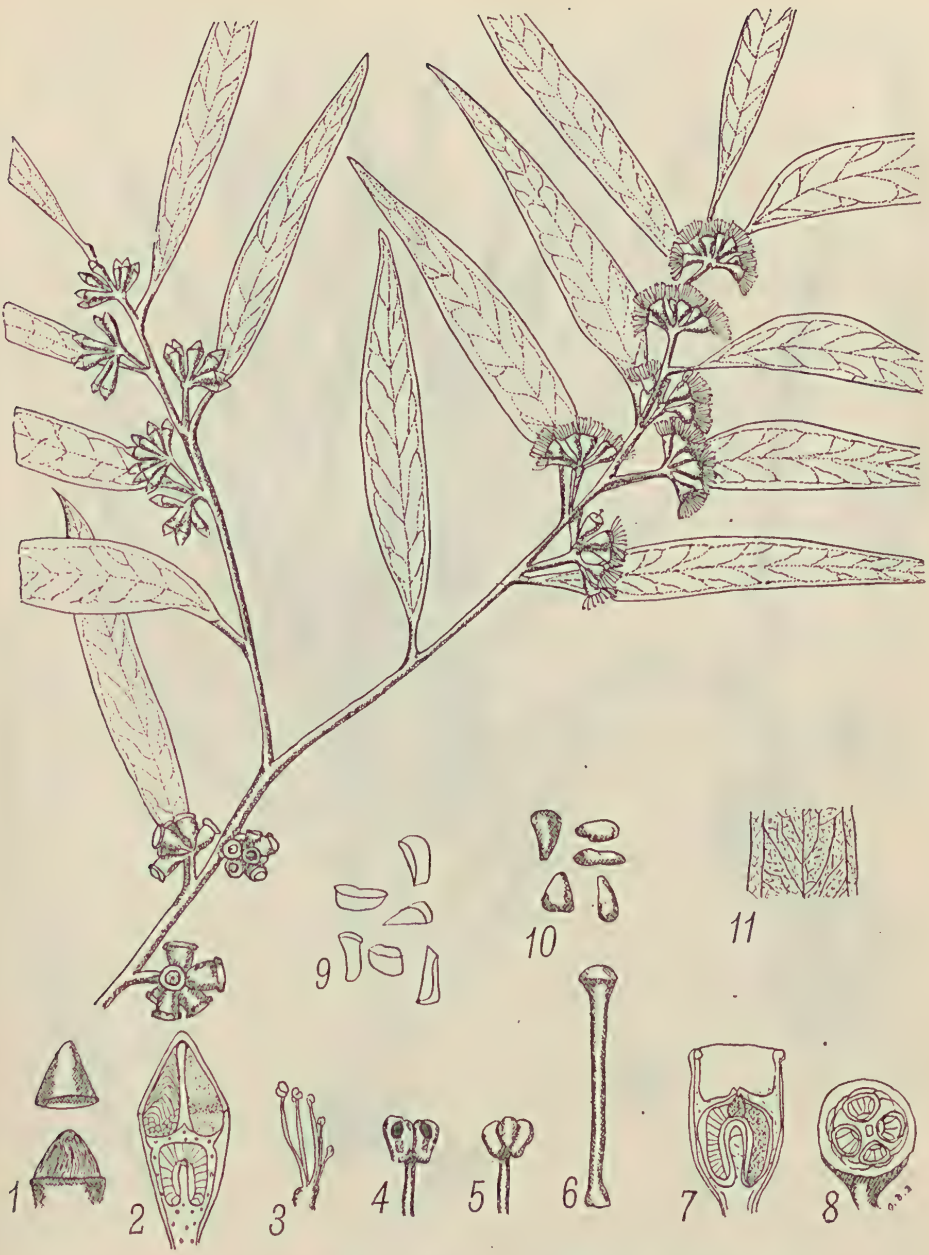

Plate CLIX.—*Eucalyptus odorata.* The Scented Box.

1. Upper portion of calyx, the lid severed.
2. Longitudinal section of an unexpanded flower.
3. Some stamens *in situ.*
4 and 5. Front and back view of an anther with part of the filament.
6. Style and stigma.
7 and 8. Longitudinal and transverse section of a fruit.
9 and 10. Sterile and fertile seeds.
11. Portion of a leaf.

Plate CLX.—*Eucalyptus viridis*. The Green Mallee.

A. Young foliage.
B. Twig, bearing buds and fruits, from the type.
C. Anther.
D. Flowering twig, with fruits.
E. Small fruited form.
F. Leaf, broader type.

Timber.—Too small to be of any great value, but the stems were used by the aborigines as spear shafts. It forms a constituent of Whip Stick Mallee and usually grows on sandy or clayey or stony plains. The root stocks form excellent firewood. It coppices freely when cut.

Eucalyptus odorata, Behr. "Scented Box." (Plate CLVIX.)

Description.—A small tree, 20 feet to 35 feet high, with a dark grey, rough, persistent bark on the main trunk and larger branches. Sometimes shrubby and of a mallee-like growth. Leaves rarely above 4 inches long and ½ inch broad, often with a pointed tip. Juvenile leaves from narrow linear to broadly lanceolate, shortly stalked, mostly opposite. Peduncles mostly axillary. Buds clavate and angular. Flowers in heads of five to eight, and pink or white. Thalamus tube campanulate about two and a half lines long and broad. Operculum hemispherical to ovoid. Stamens all perfect, two to three lines long, anthers very small, opening by oval divergent pores. Fruit obovoid-truncate or hemispherical, two lines in diameter, often angular and nearly sessile, the capsule deeply sunk.

Habitat.—A native of North-West Victoria, Rushworth, Wimmera, Dimboola; also in New South Wales and South Australia.

Oil.—The oil yield is abundant (up to 2 per cent.) and the crude brown oil is strongly scented. It contains pinene, up to 80 per cent. of cineol, and much aromadendral.

Honey.—Appears to resemble that of Yellow Box (*E. melliodora*).

Timber.—Hard, brown to yellow, heavy, durable, tough with interlocking grain. Usually small, but generally useful where of sufficient size, for posts, rails and fencing, also valuable for mauls. The tree is very commonly hollow. A cubic foot weighs 65 lb. to 70 lb. When cut, it coppices freely from the stools and is valuable for firewood in the dry districts in which it grows, usually on good wheat land. It is often known as the Scented Peppermint.

Eucalyptus viridis, R. T. Baker (*E. acacioides*, A. Cunn, M.S.). "Green Mallee." (Plate CLX.)

Description.—A Mallee shrub up to 15 feet to 20 feet height, of dense growth, but rarely more than 2 inches to 3 inches diameter, with dark-brown bark at the base and white higher up. Leaves mostly 2 inches to 4 inches long, narrow green. Flowers in clusters of seven to ten on axillary peduncles. Buds four to six lines long. Thalamus tube pear-shaped, less than two lines diameter. Operculum hemispherical, usually slightly pointed. Stamens all fertile, anthers adnate in a globular head with almost terminal pores. Fruit globular, two to three lines diameter, one to three lines long.

Plate CLXI.—*Eucalyptus stellulata.* The Black Sallee.

Branch with buds, flowers, and fruits. Bud and operculum. Cluster of four stamens. Stamen, front and back. Style and stigma.

Habitat.—A native of North-West Victoria, in the Mallee; also in New South Wales. It is the prevailing form of the Whipstick Mallee and coppices freely when cut.

Oil.—The leaves yield 1 per cent. of oil, containing about 10 per cent. to 15 per cent. of cineol; aromadendral and pinene are present.

Honey.—The flowers yield both honey and pollen, but the honey is usually mixed with that of other flowers. Flowering profuse but irregular.

Timber.—Yellow, hard and close-grained, but too small to be of economic value. Useful for firewood as "mallee roots," &c., and important as a sand stay and wind break in inland dry districts.

Eucalyptus stellulata, Sieber. "Black Sallee." (Plate CLXI.)

Description.—A small tree, 30 feet, rarely 60 feet high, and 2 feet to 3 feet diameter, with a dark mostly rough bark, the upper parts smooth and greenish or lead colour. Leaves broad or narrow lanceolate with pointed tips and parallel main veins. Seedling leaves ovate, acuminate, large and thin, nearly paired and often auriculate or stem-clasping and nearly sessile. Flowers white, very small and numerous in starlike clusters on short, usually axillary, peduncles. Stamens mostly fertile, two lines long, anthers small, reniform. Fruit globular, truncate or pyriform, two lines diameter, the valves sunk.

Habitat.—A native of North-East and East Victoria, on the Buffalo Ranges at Bright, Buchan, Lake Omeo, along the Mitta Mitta and Upper Genoa Rivers; also in New South Wales. It usually grows in good soils and near watercourses and ascends to elevations of over 3,000 feet.

Oil.—The leaves yield 0.2 per cent. to 0.3 per cent. of oil containing mainly phellandrene and sesquiterpene with traces of cineol, peppermint ketone and a cinnamon oil.

Honey.—Rarely obtained pure. Flowering irregular, usually in summer.

Timber.—The wood is apple in colour, often with gum veins and is apt to warp and crack unless slowly seasoned. It should only be cut in Autumn or Winter. When seasoned it is suitable for indoor work, furniture, &c. It provides excellent fuel, especially in high mountainous areas and even when cut green.

Eucalyptus stellulata, var. *alpina*. (*E. Mitchelli*, Cambage). "Willow Gum."

This form is considered by Cambage and also by Maiden (Critical Revision, Vol. V., Pt. 7, p. 192) as a distinct species, chiefly because it has (1) narrower leaves with more divergent and less parallel secondary

Plate CLXII.—*Eucalyptus dives*. The Blue Peppermint.

A. Juvenile leaves.
B. Flowering branch.
C. Buds.
D. Fruits.

veins ; (2) the bark smooth with only a few rough flakes at the base, instead of dark and rough on the trunk and main branches ; (3) the seedling leaves more lanceolate than ovate and more distinctly stalked.

In regard to (1), this is hardly more than a varietal distinction ; (2) a similar variation in the bark is shown in lowland and mountain grown *E. viminalis* ; (3) *E. stellulata* is more variable in its seedling leaves than most species.

The variety is confined to Mount Buffalo at an elevation of 4,400 feet. It is a small tree, reaching a height of 50 feet and a diameter of 2 feet. Its flowering appears to be confined to December or January, instead of being spread over a wider range as in the type form. A certain minimum mean temperature is necessary for flowering and this in alpine forms occurs later in the year and over a more limited range of time.

Eucalyptus dives, Schauer. "Blue Peppermint." (Plate CLXII.)

Description.—A tree sometimes attaining a height of 50 feet to 100 feet with a rough "peppermint" bark, the branches yellowish and smooth and somewhat ribbony. Leaves 2 inches to 6 inches long, and 1 to 2 inches broad, lanceolate, rather thick, with the veins spreading from the base. Juvenile leaves broad lanceolate, opposite, sessile and often almost cordate pointed at the tips and stem-clasping at the base. Flowers in clusters usually of eight to twelve. Thalamus tube short and broad, usually two lines diameter. Operculum short, blunt and nearly hemispherical. Stamens two lines long ; anthers reniform. Fruit usually truncate-ovate. Valves sunk or slightly projecting ; rim red.

Habitat.—A native of South-West and North-East Victoria, at Harrietville, on the Grampians, Mount St. Bernard, Dargo and Wentworth Rivers ; also in New South Wales.

Oil.—The leaves are rich in oil, yielding 2 per cent. to 3 per cent. by weight, containing the peppermint ketone and consisting mainly of phellandrene, with pinene and traces of aromadendral.

Honey.—Pale, scanty, candies quickly. Flowering freely and annually, October to December.

Timber.—Timber pale, rather tough and hard when dry, fairly durable, but usually with abundant gum veins and hence only suitable for rough work (fence posts, outbuildings), and forming fairly good fuel. It is often used together with the narrow-leaved species in building construction. It is usually not of very rapid growth, but seeds freely and re-establishes itself readily. Suckers freely after bush fires, but the rapidly developed straight coppice growth usually tends to form slowly-growing bent, gnarled or twisted stems after a time. It grows readily on poor soils and dry ridges and hence can be used as a source of Eucalyptus oil. It is often known as the Broad-leaved Peppermint.

Plate CLXIII.—*Eucalyptus amygdalina*. The Black Peppermint.

1. Unexpanded flower, the lid partly lifted.
2. Unexpanded flower longitudinal section.
3. Some stamens *in situ*.
4 and 5. Back and front view of a stamen and part of filament.
6. Style and Stigma.
7 and 8. Transverse and longitudinal sections of fruits.
9 and 10. Fertile and sterile seeds.
11. Portion of leaf.

BOTANIC & DOMAIN GARDENS

Eucalyptus amygdalina, Labill. "Black Peppermint." (Plate CLXIII.)

Description.—A tree sometimes attaining a height of 100 feet to 150 feet, but usually smaller (30 feet to 50 feet) with a fibrous persistent bark, closer than Stringybark, but not as close as Box bark, on the trunk and larger branches. Smaller branches with smooth or ribbony bark. Leaves 2 inches to 5 inches long, narrow-lanceolate, five to ten times as long as broad, pointed, veins few and not prominent. Juvenile leaves usually broader than the adult ones, opposite or in threes, sessile, narrowed at the base, the young stems and leaves glandular. In one form, sometimes known as *E. Risdoni*, the juvenile foliage is bluish-grey with broad bases united across the stem.

Flowers shortly-stalked, in clusters of three ot eight on axillary peduncles about a centimetre long. Thalamus tube turbinate, tapering into a short pedicel. Operculum hemispherical. Stamens two lines long. Anthers kidney-shaped, opening by divergent slits. Fruit subglobose-truncate, usually under three lines diameter, capsule level with the prominent flat rim or slightly sunk, the valves not projecting.

Habitat.—A native of South-West, South, North-East and East Victoria, usually on low, more or less sterile hills from near Ballarat to Gippsland. Also in Tasmania and New South Wales.

Oil.—Leaves with an aroma of peppermint, and yielding an abundance of oil (2 per cent. to 3 per cent.) containing cineol (about 20 per cent.), pinene, phellandrene and peppermint ketone and a little eudesmol and alcohols (geraniol, &c.). Most of the cineol comes over during the first hour's distillation. The oil from Tasmanian trees contains more phellandrene and less cineol.

Honey.—Scanty, aromatic, becoming hard and candied. Flowering is annual and profuse from October to December, but of little use for bees.

Timber.—Pale, but drying a light brown, often with gum veins. Fairly hard, tough and durable when slowly grown in exposed localities and then useful for posts. Also forms good firewood, leaving a light brown ash. When of more rapid growth on good moist soils (as in Tasmania and parts of Victoria) is freer, more fissile and can be used for shingles, furniture and building construction, but it is usually not a first class timber. A cubic foot weighs 55 lb. to 60 lb. when seasoned. Transverse breaking stress (3 ft. x 3 in. x 3 in.), 4,000 lb. to 5,000 lb. Selected pieces may have a breaking stress of over 7,000 lb.

The tree seeds freely, and regenerates rapidly after fires or cutting. The butt suckers freely and after frequent bush fires forms irregular "mallee" stumps at the ground level, which make fairly good firewood. The tree stands moderate frost, but is intolerant of severe heat and drought

Plate CLXIV.—*Eucalyptus macrorrhyncha*. The Red Stringybark.

1. Summit of calyx, the lid detached.
2. Longitudinal section of an unexpanded flower.
3 and 4. Front and back view of an anther.
5. Three stamens *in situ*, all fertile.
6. Style and stigma.
7 and 8. Longitudinal and transverse section of fruit.
9 and 10. Sterile and fertile seeds.
11. Portion of leaf.

and grows best at moderate elevations with a good rainfall. It will, however, grow on the poorest exposed soils, but is then stunted. When of moderate height it often indicates good orchard land. Variety *nitida* has broader, more leathery, leaves, a broad rim to the capsule, and the fruits usually in close clusters. Range and other characters similar to the type. The variety *linearis* has a paler bark, narrower leaves, and smaller fruits. It is often known as the Narrow-leaved Peppermint.

Eucalyptus amygdalina, Labill var. *radiata*. (*E. numerosa*, Maiden.)

This variety has a somewhat weeping habit with drooping branches and flowers numerous in dense clusters. The bark is rough and dark at the butt and smooth on the branches after the first 12 feet to 30 feet, peeling off in ribbons. It grows on flats as well as on hill-sides up to an elevation of 3,000 feet and may reach 50 feet to 150 feet high with a diameter of 2 feet to 4 feet.

Oil.—Similar to that of the type form.

Timber.—The timber is pale, tough and strong, fairly hard and can be used for furniture and tool handles, &c. Not very durable in the ground. A cubic foot weighs 50 lb. to 55 lb. Breaking strain (3 ft. x 3 in. x 3 in.), 5,000 lb. to 7,000 lb. It is a native of Victoria from Macedon to Gippsland, Gisborne, Kilmore, Buchan, Genoa, Cann River; also in New South Wales.

Eucalyptus macrorrhyncha, F.v.M. "Red Stringybark." (Plate CLXIV.)

Description.—A tall tree 70 feet to 150 feet high, with a furrowed and fibrous brown bark. Leaves rather thick, 3 inches to 6 inches long, and 1 inch to 1¼ inches broad, with prominent and parallel lateral veins. Juvenile leaves opposite, elliptical, with a waxy or toothed margin, sprinkled with stellate hairs and shortly stalked. Buds more or less angular. Flowers in clusters of six to eight on pedicels longer than the thalamus tube. Operculum conical or acuminate. Stamens all perfect, anthers reniform. Fruit usually depressed, globose, four to six lines diameter, on distinct stalks, usually with a prominent red rim and a domed top. Valves projecting.

Habitat.—A native of South-West, South, North-East and East Victoria, from Melbourne to beyond Healesville, Mountains on the Macalister River, Mount Ligar, between the Goulburn and Ovens Rivers, &c. Usually on Silurian formations and on stony ranges up to an elevation of 3,000 feet. Also in New South Wales and South Australia.

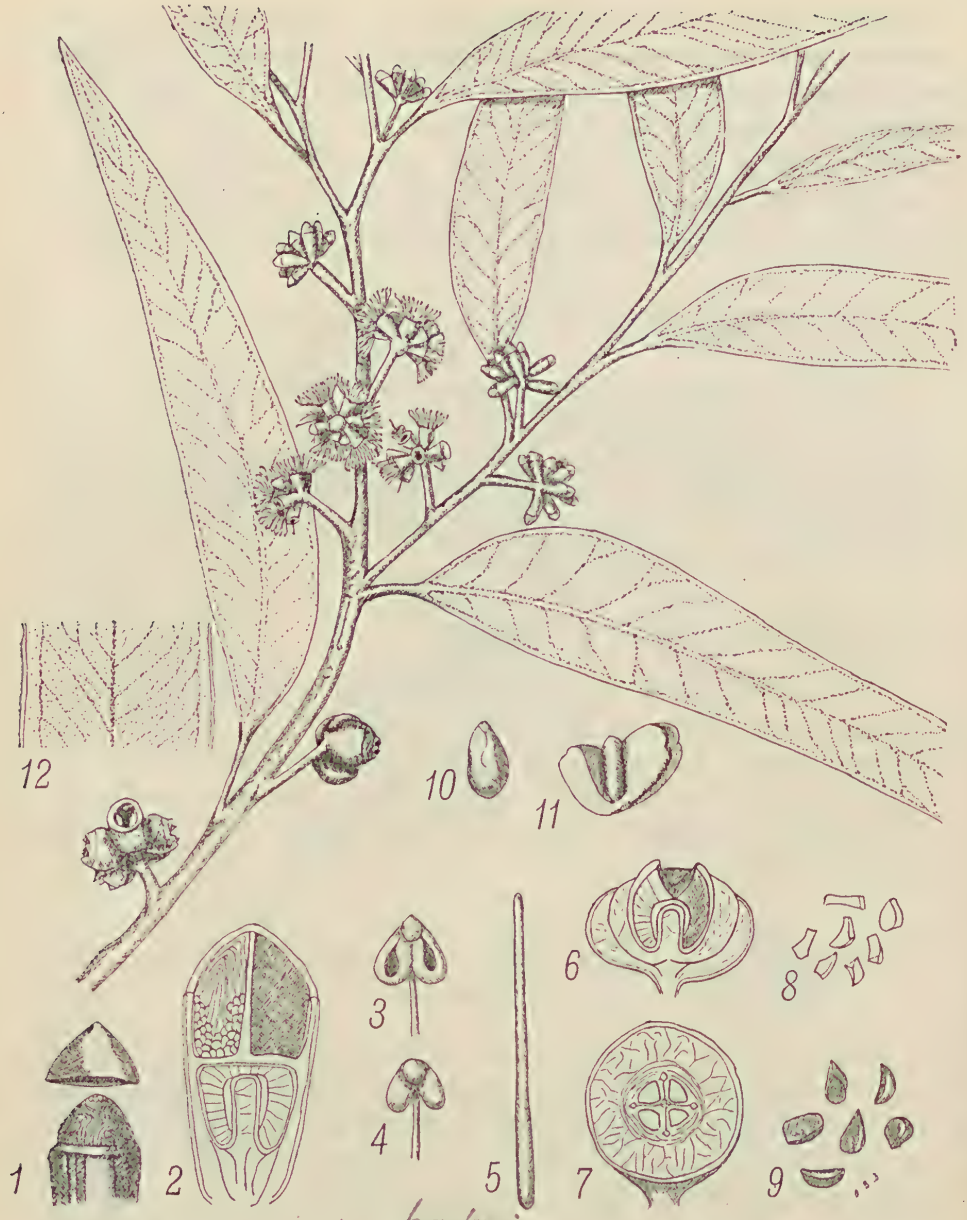

Plate CLXV.—*Eucalyptus baxteri* (~~capitellata~~). The Brown Stringybark.

Branch with buds, flowers, and fruits.

1 and 2. Bud and operculum and bud in section.
3 and 4. Front and back of anther.
5. Style and stigma.
6 and 7. Fruit in vertical and in transverse section.
8 and 9. Sterile and fertile seeds.
10 and 11. Embryo and embryo spread out.
12. Portion of leaf.

Oil.—The oil distilled from the leaves averages 0.1 per cent. to 0.3 per cent. and contains phellandrene, cineol (below 30 per cent.), eudesmol, sesquiterpene and a little pinene. The phellandrene is most abundant in Spring. The dry leaves yield about 8 per cent. of a yellow dye, myrticolorin, which is a glucoside of quercetin. It is soluble in hot water. Stock will eat the leaves in time of scarcity as the oil content is low, but they also contain 3 per cent. of tannic acid and are unsuitable for prolonged feeding.

Honey.—Rather dark, but clear and of good flavour and medium density. It candies rather readily and froths unless previously heated to 160° F. The pollen is used by bees. Usually flowers in February, but often misses one or two seasons.

Timber.—Brown, with reddish tinge, sometimes paler, close-grained, hard, tough, very durable and fissile. Useful for building construction, furniture, posts, rails, sleepers, shingles, weatherboards and also forms good fuel. It is one of the best woods for making charcoal. A cubic foot weighs 55 lb. to 63 lb. when seasoned. Tranverse breaking stress (3 ft. x 3 in. x 3 in.), 5,500 lb. to 6,500 lb. (2 ft. x 2 in. x 2 in.), 2,300 lb. to 2,500 lb. It is not quite as durable, hard and strong as the brown stringybark. Seeds freely and readily establishes itself by natural regeneration. Stands small bush fires fairly well, but the bark is apt to smoulder away locally leaving injuries which let in the white ants. The wood leaves a dark brown ash. It coppices freely when cut. It rarely grows on the plains, but favours the poor soils of Silurian hills and ranges, is resistant to moderate frost, but is intolerant of hot dry conditions. The tough fibrous bark comes off in one sheet and can be used for roofing sheds, but is highly inflammable in bush fire weather. The fibre yields rough cordage and matting and furniture packing.

Eucalyptus capitellata, Smith. "Brown Stringybark." (Plate CLXV.)

Description.—A tree growing to a height of 50 feet to 120 feet and a diameter of 2 feet to 3 feet with a thick furrowed brown fibrous bark extending to the smaller branches. Often dwarfed in exposed situations or near the sea coast. Leaves 3 inches to 6 inches long, thick, large and coarse with spreading veins. Seedling leaves sessile, broad cordate, margin sinuate and reddish when fresh, stellate hairs on the under side. Flowers sessile in clusters of five to ten, on thick, often angular or flattened peduncles. Operculum very obtuse, often double. Stamens two to three lines long, all perfect. Fruits depressed globose, four to five lines diameter, in nearly sessile heads. Rim brown or red. Valves sunk or slightly projecting.

Habitat.—A native of North-West, South-West, South, North-East and East Victoria, at Portland, on the Grampians, at Wilson's Promontory, Upper Yarra, Healesville district, &c.; also in New South Wales

Plate CLXXXII.—*Eucalyptus pauciflora.* The White Sallee.

1. An unexpanded flower, the lid lifted.
2. Longitudinal sections of unexpanded flowers.
3 and 4. Front and back view of an anther with part of the filament.
5. Stamens *in situ.*
6. Style and stigma.
7 and 8. Longitudinal and transverse section of fruit.
9 and 10. Sterile and fertile seeds.

Beneath the flowering branch, a juvenile leaf is shown in outline.

leaves a cream-coloured ash. The gum veins are often the result of bush fires which have passed over the tree, but also result from mechanical and insect injuries.

Eucalyptus pauciflora, Sieber. (*E. coriacea*, A. Cunn.)* "White Sallee."
(Plate CLXXXII.)

Description.—A tall tree, 60 feet to 100 feet high, with a smooth whitish deciduous bark, the inner layers thick, brittle, and succulent. Leaves 3 inches to 7 inches long, shortly petiolate, acuminate, lanceolate, usually falcate, thick, smooth and shining, sometimes glaucous, main veins parallel or nearly so. Juvenile leaves broadly ovate or nearly circular, paired and almost sessile. Flowers white, five to ten together on axillary peduncles. Thalamus tube very open and about three lines in diameter. Operculum hemispherical, obtuse or nearly conical, shorter than the thalamus tube. Stamens numerous, two to three lines long, anthers small reniform. Fruits pear-shaped, nearly sessile, three to four lines diameter, the capsule slightly sunk, and the valves hardly protruding.

Habitat.—A native of South-West, South, North-East, and East Victoria, at Creswick, Eltham, Buchan, Beaufort, Omeo, Delegate, at elevations up to 5,000 feet but also at low levels; also in South Australia, New South Wales, and Tasmania.

Oil.—The leaves though coriaceous are fairly succulent and are eaten by stock when fodder is scarce. They contain about 1 per cent. of tannin and 0·4 per cent. to 0·5 per cent. of pale brown oil consisting largely of phellandrene with a little cineol, peppermint ketone, pinene, eudesmol and sesquiterpene.

Honey.—Clear, transparent, golden in colour, of medium density. Bees gather the pollen. Flowering profuse but irregular.

Timber.—The wood is pale, rather soft, usually with many gum veins, and shrinks considerably on seasoning. Unless slowly seasoned it is apt to warp and is not in the first rank as a timber. It rarely lasts well in the ground but can be used for fence rails and firewood, and for posts if the well-seasoned butt is used. The variety *alpina* is simply a small leaved, shrubby alpine form growing up to an elevation of 6,000 feet.

Eucalyptus pauciflora, Sieb. var. *alpina*, "Snow Gum."

Description.—A tall shrub or small tree up to 15 feet or rarely 20 feet high. Leaves short and nearly straight, smaller than the ordinary form and more or less glaucous. Flowers white, small on short peduncles. Fruit nearly sessile, pear-shaped, three to four lines diameter, with a broad rim and sometimes slightly angular.

* Maiden (Crit. Rev. Gen. Eucalyptus, Vol. 1 part V. p. 133) adopts the later name of E. coriacea, partly on the ground that it is more appropriate. This is, however, not a valid reason for changing an established prior name.

Plate CLXVII.—*Eucalyptus Muelleriana*. The Yellow Stringybark.

1. Juvenile foliage.
2. Flowering twig. (Note the clavate buds.)
3. Twig bearing fruits. (Note nearly spherical shape and marked rims.)

Timber.—The plant is too small to yield timber of any economic value, but is of importance in holding soil and checking erosion of mountain tops. Where such shrubs are destroyed the rocky surface is soon laid bare, and the rapid run off of the rain soon sculptures the mountain into rocky ravines and increases the danger of torrential floods on lower levels. It is possible that this plant may be merely a mountain variety of *E. capitellata*, but this could only be told by noting the character of trees grown from pure seed at low elevations.

Eucalyptus Muelleriana, Howitt. "Yellow Stringybark." (Plate CLXVII.)

Description.—A large tree 60 feet to 150 feet high with a straight and rather massive trunk often over 3 feet diameter and fibrous dark grey bark, smooth on the smaller branches, the inner bark usually yellow (a peculiarity also sometimes found in *E. eugenioides*). Leaves 3 inches to 6 inches long, lanceolate, falcate, pointed. Seedling leaves lanceolate, almost or quite sessile, opposite, often with tufts of stellate hairs beneath and a shining upper surface. Flowers three to twelve in the umbels. Sapling leaves broader and horizontal. Umbels on short, stout or flattened peduncles, often several close together. Thalamus tube about as long as the pedicel. Stamens rather large and few. Anthers reniform. Operculum semi-ovate to hemispherical, rarely slightly pointed. Ovary usually four-chambered, rarely three or five. Fruit from almost hemispherical to semi-ovate and up to ½ inch in diameter, the valves usually sunk.

Habitat.—A native of East and South Victoria, in Gippsland and on Wilson's Promontory between Hoddle Ranges and the sea coast, up to elevations of 1,000 feet, on silurian sediments, sands and sandy clays. Also in South Australia, New South Wales and Queensland.

Oil.—Fresh leaves yield about 0.7 per cent. to 0.8 per cent. of oil consisting mainly of pinene and reddish in colour, but leaves from saplings usually not more than 0.4 per cent. The kino contains mainly tannic acid and water but no gum.

Honey.—Somewhat dark, but of good flavour and consistency. A good pollen yielder, usually flowering annually from December to March.

Timber.—Pale yellow to brownish yellow, hard, with a close but free grain, splits readily, free from defects, durable in fresh and salt water. Specific gravity when seasoned 0.9. A cubic foot weighs 60 lb. to 65 lb. green and 56 lb. when air dry. Transverse breaking stress (3 ft. x 3 in. x 3 in.), 7,000 lb. to 8,000 lb. Timber useful for piles, beams, rafters, weatherboards, fence posts, house, ship and carriage building. Large beams are inflammable with difficulty. The tree reproduces readily from seed, but is of slower growth than *E. pilularis*, to which it is related.

Plate CLXVIII.—*Eucalyptus eugenioides.* The White Stringybark.

1. An unexpanded flower, the lid lifted.
2. Longitudinal section of an unexpanded flower.
3. Some of the outer stamens detached.
4 and 5. Back and front view of an anther, with portion of filament.
6. Style and stigma.
7 and 8. Transverse and longitudinal section of a fruit.
9 and 10. Fertile and sterile seeds.
11. Portion of a leaf.

Eucalyptus eugenioides, Sieber. "White Stringybark." (Plate CLXVIII.)

Description.—A tree sometimes attaining a height of 100 feet to 150 feet, but usually 50 feet to 100 feet with fibrous furrowed bark up to the smaller branches, usually greyish outside, then brown and reddish or yellow on the inside, but hard and dense on the outside. Leaves shining and dark green on both sides, usually clustered at the ends of the branches. Seedling leaves opposite, sessile or nearly so, lanceolate, usually narrow, sprinkled with stellate hairs. Flowers about six to twelve together on short thick pedicels and rather crowded into heads.

Thalamus tube longer than the operculum and tapering into a short pedicel. Stamens all perfect, about two lines long. Operculum usually semi-ovate and pointed. Fruit truncate globular or nearly hemispherical, rarely nearly globular, usually with a red rim and valves sunk or slightly projecting. The fruits are usually crowded into globular heads, but do not compress one another laterally as in *E. capitellata*.

Habitat.—A native of East Victoria, in Gippsland, Stratford, Bairnsdale, Buchan, and also in mountainous regions (Macalister River, &c.) up to 3,000 feet; also in New South Wales and Queensland.

Oil.—The pale yellow oil obtained by distillation of the leaves contains pinene, cineol (about 30 per cent.) and sesquiterpene. Average yield 0.7 per cent. The amount of cineol increases after exposure to air.

Honey.—Dark, of the usual stringybark type. Bees use the pollen. Flowering usually annual in January and February.

Timber.—The wood is pale brown to reddish brown, hard, and often somewhat resembles that of *E. capitellata*. It is of rapid growth, is free from gum veins and is a generally useful timber, which splits readily and can be used for posts, rails, wood blocks, sleepers and building and ship construction. Useful also for wood carving. Young trees make good telegraph poles. A cubic foot of air-dry timber weighs 53 lb. to 55 lb. and 72 lb. green. Transverse breaking stress (3 ft. x 3 in. x 3 in.) 8,000 lb. to 10,000 lb. Tensile breaking stress 19,000 lb. per square inch. It forms useful fuel, especially for burning bricks, and leaves a yellowish brown ash.

The tree seeds freely, and readily regenerates by natural reproduction if stock are kept off the land. It does not thrive under hot dry conditions, stands moderate frost and prefers a cool moist climate. The bark yields rough cordage and matting.

Plate CLXIX.—*Eucalyptus haemastoma.* The Scribbly Gum.

1. Upper portion of calyx, the lid detached.
2. Longitudinal section of unexpanded flower.
3 and 4. Front and back view of anther.
5. Sterile and fertile anther *in situ*.
6. Style and stigma.
7 and 8. Longitudinal and transverse sections of fruit.
9 and 10. Sterile and fertile seeds.
11. Portion of leaf.

Eucalyptus eugenioides, Sieb. var *nana*, Deane & Maiden. "Dwarf Stringybark." (Plate CLXVIII.)

Description.—A dense shrub 5 feet to 10 feet high. Leaves 2 inches long by ½ inch broad. Flowers six to twelve together on short thick pedicels. Fruit truncate-globular with a depressed rim.

Habitat.—A native of East Victoria, in Gippsland, in the Buchan district.

Timber.—Too small to be of economic value.

Eucalyptus haemastoma, Smith. "Scribbly Gum." (Plate CLXIX.)

Description.—A tree growing to a height of 100 feet to 120 feet, but usually up to 50 feet with a diameter of 2 feet, with a smooth deciduous bark rarely rough and persistent at the base. Stem usually much branched and crooked. Leaves 3 inches to 6 inches long, lanceolate, pointed, coriaceous. Seedling leaves stalked, opposite, larger and broader than the adult leaves. Flowers on angular or compressed pedicels, in clusters of four to eight in short terminal or oblong panicles.

Thalamus tube two lines diameter, longer than the operculum and tapering into a short pedicel. Operculum short and hemispherical or pointed when young. Stamens two to three lines long, anthers reniform, but absent from the outer stamens. Fruit globular truncate or pear-shaped, more often the latter, three to four lines diameter, with a broad, nearly flat, brown or red rim.

Habitat.—A native of North-East Victoria, at Beechworth, &c.; also in New South Wales from the coast to inland hilly districts; also in Tasmania and in Queensland. The small-flowered form, known as variety *micrantha*, appears to have a wider range than the type form. The name "Scribbly Gum" is derived from the almost invariable presence of insect markings on the white bark, like scribbles.

Oil.—The leaves yield 0.2 per cent to 0.3 per cent of red viscous oil containing cineol (about 15 per cent.), phellandrene, eudesmol, sesquiterpene (about 20 per cent.) and a little pinene. The chief constituent is phellandrene.

Honey.—Rarely obtained pure.

Timber.—Wood red, durable in the ground, forms good fence posts, is less suitable for building construction, being rather brittle, but can be used for furniture, 3-ply veneers, &c. Long lengths are rarely obtainable, but the waste wood forms good fuel. The tree appears to be a cold-fearing plant and does not thrive in hot and dry districts or on exposed plains. A cubic foot averages 68 lb. Transverse breaking stress (6 ft. x 2 in. x 2 in.), 900 lb.

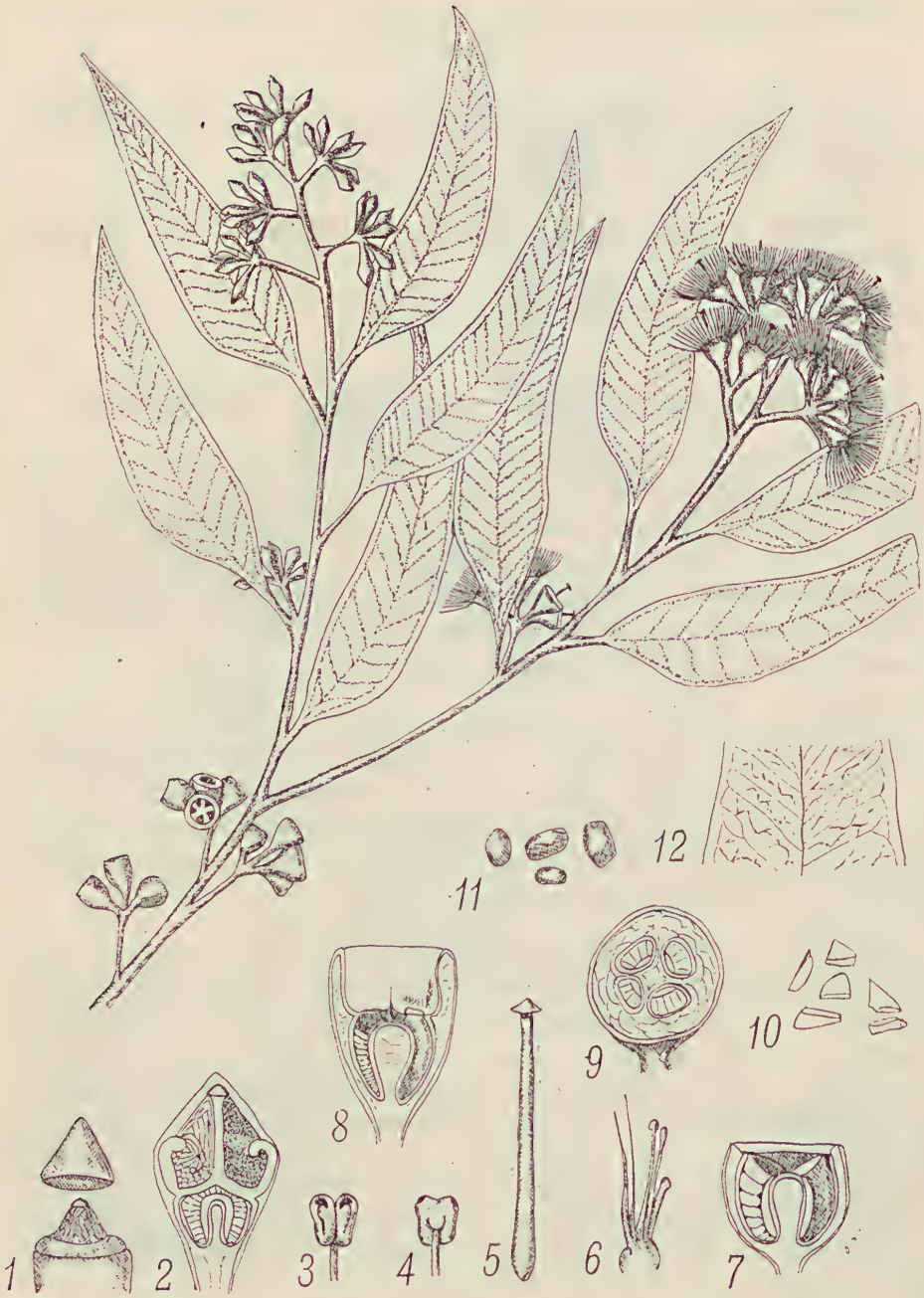

Plate CLXX.—*Eucalyptus paniculata.* The Grey Ironbark.

1. Upper part of an unexpanded flower, the lid lifted.
2. Longitudinal section of an unexpanded flower.
3 and 4. Front and back view of an anther with portion of its filament.
5. Style and stigma.
6. Stamens *in situ*.
7 and 8. Longitudinal sections of two fruits.
9. Transverse section of a fruit.
10 and 11. Sterile and fertile seeds.
12. Portion of leaf.

Eucalyptus paniculata, Smith. "Grey Ironbark." (Plate CLXX.)

Description.—Usually a tree of moderate size but sometimes 80 feet to 120 feet high and 3 to 4 feet diameter and with a pale or greyish-brown persistent, somewhat furrowed, hard "ironbark." Sometimes the bark flakes off, leaving a smooth greyish stem. Leaves lanceolate, 3 inches to 5 inches long, rather narrow, stalked and pointed. Juvenile leaves stalked, broadly ovate, soon becoming alternate and lanceolate. Flowers usually in clusters of three to six in a short terminal corymbose panicle. Thalamus tube two to three lines diameter, more or less angular, tapering into a short pedicel. Operculum short and conical. Stamens two to three lines long or sometimes more. Anthers with terminal pores. Fruit two to four lines diameter, usually small and globose truncate or larger and almost cylindrical.

Habitat.—A native of East Victoria, on Mount Taylor, near Bairnsdale, at Mallacoota, &c. Also in Queensland, New South Wales and South Australia, and extending along the coastal districts into Victoria.

Oil.—Olive-brown and aromatic. Yield 0.1 per cent. Mainly of pinene and sesquiterpene, with some cineol (about 20 per cent.), alcohols and volatile aldehydes.

Timber.—Hard, pale or white, or pinkish when freshly cut, usually darkening to grey or even light brown after cutting*; tough, strong, durable, usually with an interlocked grain, but sometimes fissile. The transverse breaking stress (3 ft. x 3 in. x 3 in.) is 7,500 lb. to 10,500 lb. A valuable timber for beams, piles, bridges, sleepers, spokes, naves, and building and wagon construction. The wood is hard to work or plane smooth and nails are difficult to drive into it. A cubic foot weighs 65 lb. to 70 lb. when air dry and 76 lb. green. It usually grows in moist coastal localities on poor rocky ridges unsuitable for cultivation, but also grows in suitable inland localities. It is usually of rather slow growth, but may attain a height of 40 feet and a diameter of a foot in twelve to fifteen years on good soils. It stands moderate bush fires fairly well, but does not re-establish itself readily where grazing is permitted. It seeds fairly well and seedlings transplant well. It is a cold-fearing plant and does not stand heat and drought or dry conditions well, although it grows on poor soils which may appear superficially to be dry.

Eucalyptus melliodora, Cunn. "Yellow Box." (Plate CLXXI.)

Description.—A low tree of irregular growth, sometimes 50 feet to 100 feet high, and 4 feet in diameter, sometimes with a smooth bark but more usually with a furrowed and persistent hard sub-fibrous box bark of a

* The older wood in some forms is of a deeper brown or red colour. Baker proposes to separate these as distinct species, *E. Fergusoni* (red), and *E. Nanglei* (brown), but it is doubtful whether they represent more than local variations. The timber of *E. paniculata*, var. *angustifolia* (*E. Beyeri*, Baker) is usually deep brown in colour.

Plate CLXXI.—*Eucalyptus melliodora*. The Yellow Box.

1. Summit of calyx, lid detached.
2. Longitudinal section of unexpanded flower.
3. Some sterile and fertile stamens in situ.

4 and 5. Front and back view of anther.

6. Style and stigma.

7 and 8. Longitudinal and transverse section of fruit.

9. Seeds.
10. Portion of leaf.

pale lead colour on the trunk, extending upwards along the branches to a variable extent. The branches are often drooping. Leaves 2 inches to 4 inches long and ¼ inch to ½ inch broad, rather leathery narrow-lanceolate, narrowed to a petiole. Juvenile leaves broadly lanceolate, stalked, opposite or alternate. Flowers in sweet-smelling axillary clusters of three to eight, on pedicels of one to two lines. Thalamus tube campanulate about two lines long and broad. Operculum hemispherical or shortly conical. Stamens about two lines long, the outer ones usually sterile, anthers with terminal pores. Capsule sub-globose, i.e., like an egg with the small end cut away.

Habitat.—A native of North-West, South-West, South, North-East and East Victoria, in Gippsland, Myrniong, Tambo, Grampians, Chiltern, Maryborough. Usually in scattered localities not forming definite forests, from plains and river banks to moderate elevations on hill-sides. It prefers good soil, and stands hot, dry winds well but not severe cold, requiring a rainfall in Victoria of 15 inches to 20 inches. It also occurs in New South Wales and Queensland.

Oil.—The fresh leaves yield 0.8 per cent. to 0.9 per cent. of red oil, consisting of 50 per cent. to 60 per cent. of cineol, with sesquiterpene, volatile aldehydes and esters. Some pinene is present especially in summer and sometimes a trace of phellandrene.

Honey.—The profuse fragrant flowers yield good, pale, aromatic, dense honey. Bees make little or no use of the pollen. The flowering is biennial over large areas and lasts from November to February.

Timber.—Very hard, tough, durable, with an interlocked grain and a pale yellowish colour, drying a light brown. The trunk is often piped in old trees. Useful for gate posts, and for saw milling (bridge decking, piles, sleepers), when of straight growth, but rarely very tall and usually of gnarled and twisted habit, then yielding good firewood, leaving a pinkish white ash. A cubic foot weighs 60 lb. to 65 lb. when air dry. It is of slow growth with a small annual timber increment. The name "Yellow Box" is derived from the yellow colour of the inner bark which readily distinguishes it from *E. Bosistoana*, which has a white inner bark.

It seeds freely and re-establishes readily if protected from stock. The early growth is fairly rapid but the rate soon decreases so that full maturity is only reached slowly although flowering may begin when seven years old or even earlier. It coppices fairly well when cut.

Eucalyptus sideroxylon, Wools. "Red Ironbark." (Plate CLXXII.)

Description.—A medium sized tree 40 feet to 60 feet, and 1 foot to 3 feet diameter, but sometimes 90 feet to 150 feet high, with a dark red or dark brown rough persistent bark, spotted with dark kino grains. Leaves 3 inches to 6 inches long on short stalks, lanceolate, usually

Plate CLXXII.—*Eucalyptus sideroxylon*. The Red Ironbark.

A. Flowering branch.
B. Seedling.
C. Natural seedling.
D, E and F. Types of fruit.

narrow, rather pale green, often silvery. Juvenile leaves mostly opposite, shortly stalked, rather narrow lanceolate. Flowers usually pink and large in clusters of three to seven or more on pedicels often as long as the angular thalamus tube. Operculum conical, hemispherical or acuminate. Stamens usually very unequal, red or white, the anthers with terminal pores. Fruit obovoid or turbinate to sub-globular, sometimes tuberculate, but usually smooth. Seeds dark or blackish.

Habitat.—A native of East Victoria, in Gippsland, on Panton Hill, near Bendigo, Maryborough, Rushworth, Chiltern (in State reserves), also in New South Wales, Queensland and South Australia.

Oil.—The leaves yield from 0.5 per cent. to 1 per cent. of reddish-yellow oil, rich in cineol (up to 60 per cent.), but also containing pinene, volatile aldehydes and sesquiterpene.

Honey.—Pale, straw colour, dense, clear, mild in flavour. Value for honey and pollen small owing to annual flowering being usually in Winter, June to September, rarely in Autumn or late Summer.

Timber.—Sap-wood yellow, heart-wood red, hard, durable, valuable for timber, piles, poles, props, hubs, spokes, shafts, sleepers, furniture and general purposes, but rarely yielding heavy beams. When grown in dry districts it is apt to shell out badly in curved sections when sawn. A cubic foot weighs 65 lb. to 70 lb. when air dry. It leaves a pinkish grey ash when burnt.

The tree is of fairly rapid growth and is frequently planted. It reproduces well by coppice growth, and more rapidly and readily than when grown from seedlings. In Gippsland it is usually scattered from sea-level to 2 000 feet, but over the rest of Victoria it occurs in open forest, on plains or gentle elevations, usually on sedimentary formations or on the quartz ironstone ridges of auriferous districts. It seeds fairly well, but often misses a season or two. It endures severe temporary drought and heat, but usually requires a rainfall of not less than 18 inches to 20 inches, and is resistant to moderate frost. It is a serviceable wind-break and shade tree and its flowers yield much honey.

Eucalyptus leucoxylon, F.v.M. "Yellow Gum" or "White Ironbark."
(Plate CLXXIII.)

Description.—A medium sized tree, sometimes attaining 60 feet to 90 feet, with a smooth whitish bark, rarely rough at the butt. Leaves bluish-green, usually 3 inches to 6 inches long, narrow lanceolate, tapering. Juvenile leaves paired, sessile, broadly ovate pointed to orbicular. Flowers pale yellow, three, sometimes more, together on a slender peduncle. Thalamus tube semi-ovate rather longer than the conical-hemispherical, acuminate operculum. Stamens usually very unequal, anther with terminal pores. Fruit almost hemispherical, three, rarely four lines diameter, the valves sunk.

Plate CLXXIII.—*Eucalyptus leucoxylon.* The Yellow Gum or White Ironbark.

Shoot with leaves, buds, flowers, and fruits.
A sterile and three fertile stamens *in situ,* and enlarged.
Style and stigma.
A ripe fruit and a bud, enlarged.

Habitat.—A native of South-West, South, North-East and East Victoria, along the Avoca and Murray Rivers, &c., Bendigo, Heathcote, Maryborough, the Grampians, Horsham, Glenelg, Wimmera, also more rarely in South Australia (Kangaroo Island, &c.), New South Wales and Queensland.

Oil.—The leaves yield 0.7 per cent. of a reddish oil, containing terpenes (pinene and limonene), volatile aldehydes and about 30 per cent. of cineol, but no aromadendral or phellandrene.

Honey.—Pale, straw colour, dense, clear, mild in flavour. Pollen little used. Flowering annual, but more abundant in alternate years. Flowering varies from June-December (Grampians), April-November (Bendigo), or September-November (Mallee). Flowering often begins in the third or fourth year.

Timber.—Pale, pinkish or pinkish-yellow, tough, hard and durable when grown in dry localities. Then useful for pit props, sleepers, posts, planking, naves, felloes, shafts, and telegraph poles. It varies considerably in regard to the strength and quality of the timber according to the locality and conditions of growth. The best qualities have a transverse breaking stress (3 ft. x 3 in. x 3 in.) of 7,000 lb. to 10,000 lb. The tree seeds fairly well, but fails to re-establish on grazed land. It usually stools readily when cut low near the surface of the ground, forming an abundant coppice growth, from which axe and tool handles can be made. The tree is of rapid growth, will stand frost as well as temporary extremes of heat and drought and will grow on poor soils. It can be grown for windbreaks and fuel where less hardy Eucalypts do not thrive. The large fruited variety known as variety *macrocarpa* has a pink flowered form which is a handsome garden tree, growing best in sheltered localities.

Eucalyptus obliqua, L'Heritier. "Messmate Stringybark." (Plate CLXXIV.)

Description—A large tree, 80 feet to 250 feet high, and 3 feet to 8 feet or even 12 feet diameter, of rapid growth, with a straight clean trunk covered with rugged persistent fibrous brown or dark bark to the smaller branches, which have a glaucous surface. Leaves usually 4 inches to 6 inches long, with a very oblique base as in *E. capitellata*, ovate, acute, with few main veins. First seedling leaves broad, ovate and opposite, very shortly stalked or sessile, rapidly becoming alternate, stalked, lanceolate and oblique. Flowers in clusters of four to eight on stout axillary peduncles. Thalamus tube turbinate.

Operculum hemispherical or obtuse and flattened. Stamens three lines long, all perfect, anthers reniform with a small appendix. Fruit pear-shaped, three to five lines diameter, rim broad, capsule more or less sunk.

Plate CLXXIV.—*Eucalyptus obliqua*. The Messmate Stringybark.

A. Large juvenile leaf.
B. Branch with buds and flowers.
C. Fruits.

1 and 2. Bud and operculum and bud in section.
3 and 4. Front and back of anther.
5. Portion of stamens.

Habitat.—A native of South-West, South, North-East and East Victoria, usually on hills and extending from Gippsland to the Grampians and Otways. Often forming the chief constituent of large stringybark forests, and more common on old silurian formations than on rich chocolate or volcanic soils. It stands moderate frost, but not severe drought or heat. Also in Tasmania, New South Wales, and South Australia. This was the first species of eucalyptus to be botanically described, (1788).

Oil.—The leaves yield about 0.5 per cent. to 0.7 per cent. of oil, containing mainly phellandrene with some aromadendral and a little cineol.

Honey.—Dark, somewhat like molasses. Bees use the pollen. Flowering is usually in February and March, and provides autumn and winter feed for bees.

Timber.—Pale straw colour, durable, straight grained with well developed pores. It splits freely, and when seasoned has a specific gravity of 0.9. A cubic foot weighs 45 lb. to 50 lb. air-dry, 65 lb. green, and 38 lb. to 40 lb. dry. It is strong, tough and durable. Transverse breaking stress (3 ft. x 3 in. x 3in.), 5,500 lb. to 7,000 lb. or (2 ft. x 2 in. x 2 in.), 2,000 lb. or (1 ft. x 1 in. x 1 in.), 1,220 lb. seasoned, 682 lb. green. A most useful general purpose timber for piles (in fresh water), posts, rails, palings, shingles, sleepers, telegraph poles, weatherboards, paving blocks, furniture fittings, and cabinet work. Equal to English oak. Timber grown in the less favorable climate of New South Wales is not as valuable. Large beams are very fire resistant, and the trees stand bush fires fairly well. The wood leaves a cream-coloured ash. Bush fires, however, tend to cause gum veins in the timber, depreciating its value. Like all stringybarks, when closely planted it disarticulates the lower dead branches, a layer of wood at the base of the branch being dissolved into a gum layer, so that a touch brings away the branch with a sliver of the outer bark. If the branch is large the pocket left may persist and become buried in the wood as a gum pocket.

It seeds freely, re-establishes itself readily, and is of rapid straight growth, after the first year often growing 5 or 6 feet a year. It grows best in hilly localities up to 2,000 feet, but will grow at higher elevations, often doing well on poor Silurian soils or stony ranges. In seasoning, the timber shrinks 2 per cent. in length, 6 per cent. radially and 8 per cent. tangentially. The fibrous inner bark has been used for paper-making, rough cordage, and matting.

Eucalyptus santalifolia, F.v.M.* "Sandal Gum." (Plate CLXXV.)

Description.—A large shrub, or a tree rarely attaining a height of 30 feet to 60 feet, with smooth bark. Leaves up to 3 inches long, stalked, rather thick and rigid, acute and oblong or lanceolate. Juvenile leaves

* Mr. Maiden considers this species to be a synonym to Bonpland's *E. diversifolia* which latter again Bentham considers to be a synonym of *E. viminalis*. Bonpland's descr ption, though a long one, is so general in character that it might be referred to at least six different species of eucalyptus.

Plate CLXXV.—*Eucalyptus santalifolia*. The Sandal Gum.

1. An unexpanded flower, the lid lifted.
2. Longitudinal section of an unexpanded flower.
3. Some stamens *in situ*.

4 and 5. Front and back view of an anther, with portion of its filament.

6. Style and stigma.
7. Transverse section of two fruits
8. Longitudinal section of a fruit.

9 and 10. Fertile and sterile seeds.

11. Portion of a leaf.

Plate CLXXVI.—*Eucalyptus piperita.* The Peppermint Stringybark.

Branch with leaves, buds, flowers and fruit, and beneath, juvenile foliage in outline.

1. Upper portion of an unexpanded flower, the lid lifted.
2. Longitudinal section of an unexpanded flower.
3 and 4. Front and back view of an anther with portion of the filament.
5. Some stamens *in situ*, the anthers seen from the side.
6. Style and stigma.
7 and 8. Longitudinal and transverse section of fruit.
9 and 10. Fertile and sterile seeds.
11. Portion of a leaf.

opposite, lanceolate, pointed, sessile. Flowers in clusters of six to eight in axillary peduncles, rarely less, on very short pedicels. Thalamus tube short, two lines in diameter. Stamens three lines long. Anthers, reniform. Fruit nearly globular, ½ inch in diameter, sometimes less, rarely more, valves sunk or slightly protruding.

Habitat.—A native of South-West Victoria, at Cape Nelson, Portland, Mallee Scrub on the Murray; also in South and Western Australia, usually near the coast in sand dunes, &c.

Oil.—Fresh leaves yield 0.4 per cent., consisting mainly of terpenes with a little cineol (about 10 per cent.), but no phellandrene. It has no commercial value.

Honey.—Fairly abundant, but rarely obtained pure.

Timber.—The wood is usually too small to be of use as timber, but can be used for turnery and makes good firewood. The tree is valuable for covering and holding sand dunes in dry districts where sand-blows are apt to occur. On this account the tree should be maintained wherever it grows naturally.

Eucalyptus piperita, Smith. "Peppermint Stringybark." (Plate CLXXVI.)

Description.—A medium sized tree, sometimes attaining a height of 80 feet to 100 feet, but usually not more than 40 feet to 50 feet, with a diameter of 1 foot or so, with a persistent fibrous bark, smooth on the branches, and tending to peel in ribbons at high elevations. Leaves above 1 inch to 6 inches long, falcate, acuminate, oblique. Juvenile leaves opposite, decussate, sessile, glabrous, cordate at the base, broadly ovate or lanceolate. Flowers in clusters of six to twelve on axillary peduncles. Operculum conical or acuminate, straight or curved. Stamens all perfect, about two lines long, anthers reniform. Fruit urceolate to obovoid or nearly globular, usually two to three lines diameter.

Habitat.—A native of East Victoria, in Gippsland, &c., but commoner in New South Wales and Queensland.

Oil.—The oil is abundant, the leaves yielding 0.8 per cent. or more, and in addition to phellandrene it contains eudesmol and piperitone (the peppermint ketone), a solid camphor, sesquiterpene, a little pinene, and about 20 per cent. of cineol. It was possibly from this tree that the first distillation of eucalyptus oil was made by Denis Considen.

Timber.—Pale, hard, straight-grained, but not always splitting well, liable to gum veins, and of medium strength (transverse breaking stress 3 ft. x 3 in. x 3 in., 5,000 lb. to 6,000 lb.) and durability. Hence only a second quality timber, but useful for purposes where cheapness is essential. The stem is often bent and the branches gnarled, or twisted, but the wood forms fairly good fuel if cut green and then dried. When dry it

Plate CLXXVII.—*Eucalyptus pilularis.* The Black Butt.

1. Portion of unexpanded flower, the lid lifted.
2. Longitudinal section of an unexpanded flower.

3 and 4. Front and back view of an anther with part of filament.

5. Stamens *in situ*, their anthers presented at a side view.
6. Style and stigma.
7. Longitudinal section of a fruit, the valves sunk abnormally deep.
8. Longitudinal section of an ordinary fruit.
9. Transverse section of fruit.

10 and 11. Fertile and sterile seeds.

12. Portion of a leaf. (The juvenile foliage is shown in outline beneath the flowering branch.)

is tough and hard to cut. A cubic foot weighs 52 lb. to 58 lb. The tree reproduces itself readily by coppice, suckers and seedling growth. It grows on almost any kind of soil or formation, but usually on poor soil on the lower elevations of mountainous regions, but does not stand heavy frost or hot dry climates.

Eucalyptus pilularis, Smith. "Blackbutt." (Plate CLXXVII.)

Description.—A fairly large tree, attaining a height of 100 feet to 150 feet, and a diameter of 3 feet to 8 feet above the buttresses, with a furrowed persistent bark, and usually a broad dark buttressed base, but the branches smooth and white. Leaves 3 inches to 6 inches long, sometimes almost hooked and white at the tip, petiole broad and flat. Juvenile leaves narrow, opposite, or rarely single, narrow lanceolate, often with a wavy or toothed edge and sometimes hairy. Flowers six to twelve together, the umbels lateral, or in a terminal panicle. Operculum conical or acuminate. Thalamus tube about as long (two lines) as broad. Stamens all perfect, two to three lines long. Anthers reniform. Fruit usually semi-ovate or sub-globose and about four to five lines diameter, rim narrow or broad, the valves usually sunk.

Habitat.—A native of North-East and East Victoria, along the Mac-Alister River, in Gippsland, on Wilson's Promontory, &c.; also in New South Wales and Queensland.

Oil.—Fresh leaves yield from 0.08 per cent. to 0.2 per cent of amber coloured, rank smelling oil, consisting mainly of pinene and phellandrene with a little cineol and sesquiterpenes and alcohols.

Timber.—Wood pale to dull brown, usually tough and fairly durable. Small concentric gum veins are often present. Grain straight, hard, strong. White ants attack the green timber, but only rarely the dry timber. Useful for paving blocks, house, carriage, waggon, and ship building, bridge planking, railway sleepers, posts and wheels. Transverse breaking stress (3 ft. x 3 in. x 3 in.), 7,500 lb. to 10,000 lb. A cubic foot weighs 55 lb. to 60 lb. when seasoned, 56 lb. to 57 lb. with 15 per cent. of moisture, 66 lb. when green. It works and dresses well, but blunts tools rather rapidly owing to the presence of minute particles of silica in the wood. It cracks, and is apt to warp or twist unless well seasoned. The trunk exudes a soluble astringent kino.

It reproduces readily from self-sown seed after felling, and grows best on rich moist soils usually at low elevations. It is of rapid growth when young, attaining 15 feet to 30 feet in three to four years, and 50 feet with a diameter of 1½ feet in 25 years, in coastal or cool inland districts, but does not stand severe frost or hot dry climates. This is one of those trees which as they grow on land useful for agriculture have suffered terribly from land settlement. Reserves on which the tree grows should be protected from further encroachment at all costs.

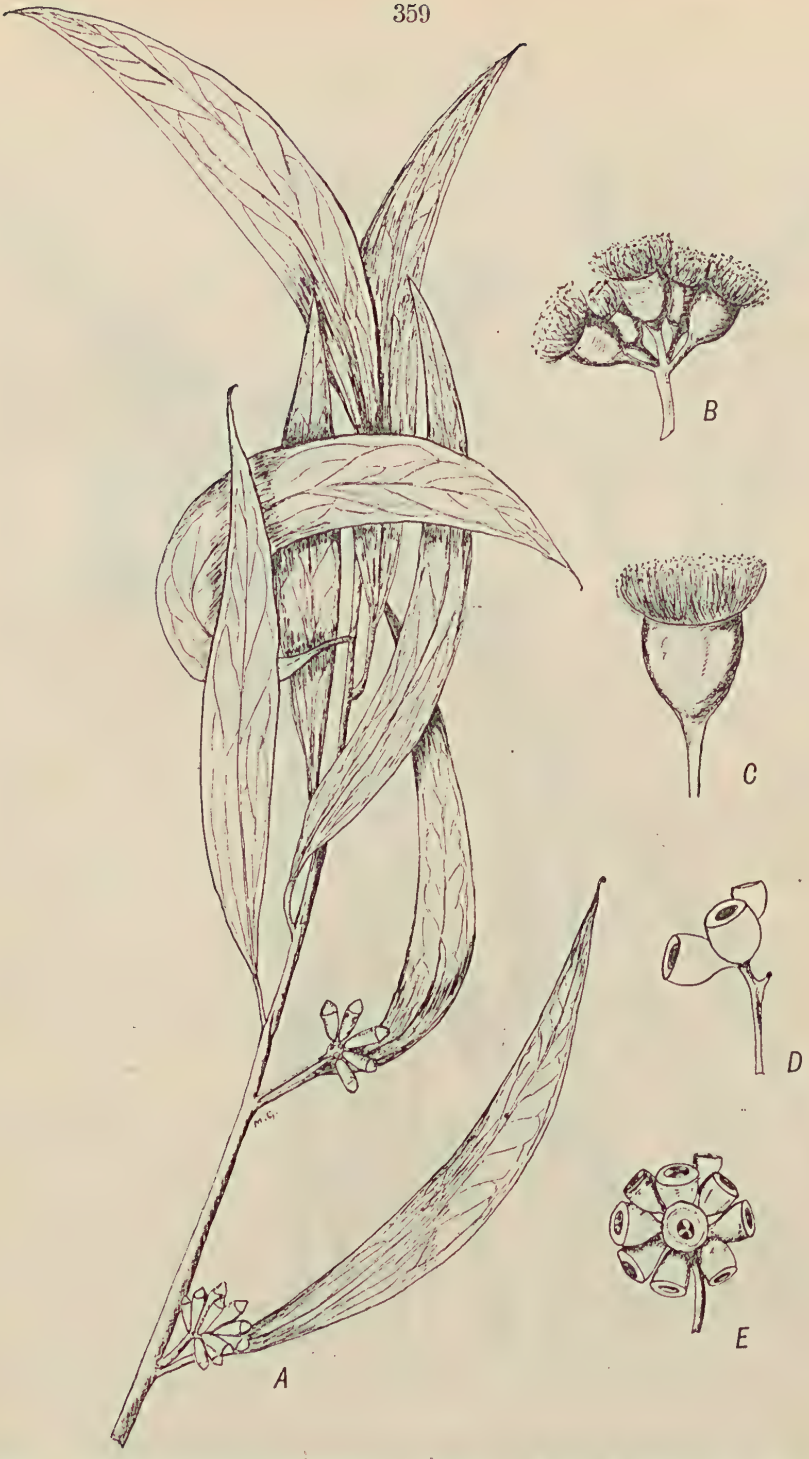

Plate CLXXVIII.—*Eucalyptus vitrea.* The White-top Gum.

A. Branch with buds.
B. Flower cluster.
C. Single flower.
D. Young fruits.
E. Cluster of older dehisced fruits.

Plate CLXXIX.—*Eucalyptus radiata.* The River White Gum.

A. Juvenile foliage, showing glandular character.
B. Flowering branch, showing pendulous habit.
C. Fruits.

Eucalyptus vitrea, R. T. Baker. "White-top Gum." (Plate CLXXVIII.)

Description.—A tree reaching a height of 70 feet to 150 feet, with a roughish "peppermint" bark, smooth on the terminal branches. Leaves 6 inches long, six to nine lines broad, lanceolate, shining on both sides, and with numerous oil glands. Juvenile leaves ovate to lanceolate, soon becoming stalked and alternate. Flowers in clusters of five to eight, on axillary peduncles two to three lines long.

Buds from two and a half to four lines long. Thalamus tube conical, longer than the operculum. Operculum hemispherical or slightly pointed. Anthers reniform, with a prominent connective. Fruit hemispherical, about three lines diameter, with a thick red rim, and on a very short stalk.

Habitat.—A native of South Victoria, in the Eltham district, &c.; also in New South Wales.

Mr. Maiden considers this species to be a natural hybrid between *E. amygdalina* and *E. pauciflora* (*coriacea*), but it has not been reproduced artifically and appears to be constant in character.

Oil.—The leaves yield 1 per cent. to 1½ per cent. of pale oil, consisting largely of phellandrene, with cineol (20 per cent. to 25 per cent.) and sesquiterpene. A little peppermint ketone and the lemon-scented citral were also present. It has a pleasant aroma.

Timber.—Pale or pale brownish, close-grained, usually full of gum veins, and apt to crack badly on seasoning. Fairly durable, and can be used for posts, but not a good working timber. Yields firewood of moderate quality. A cubic foot weighs 60 lb. to 65 lb.

Eucalyptus radiata, Sieb. "River White Gum." (Plate CLXXIX.)

Description.—A tree sometimes attaining a height of 50 feet to 150 feet, but more usually under 50 feet, with a diameter of 1 foot to 2 feet, with a fibrous "peppermint" bark, smooth up the branches and peeling off in long ribbons. Leaves 2 inches to 7 inches long, usually narrow, but often over 1 inch broad. Juvenile leaves narrow lanceolate, usually in opposite pairs, occasionally in threes. Flowers in many flowered umbels, sometimes of 20 to 40 flowers. Thalamus tube turbinate, about twice the length of the hemispherical operculum. Stamens two lines long, anthers kidney shaped, opening by divergent slits. Fruit almost pear-shaped or pilular, two to two and a half lines diameter, on rather long slender pedicels, the valves sunk or slightly projecting.

Habitat.—A native of East Victoria, in Gippsland, Boggy Creek, Stony Creek, Omeo, Mount Macedon, Lilydale, Warburton, Healesville, Daylesford; also in New South Wales.

Plate CLXXX.—*Eucalyptus gigantea*. The Red Mountain Ash.

A. Flowering twig reproduced from Hooker's "Flora of Tasmania."
B. Leaf and fruit from same plate.
C. Fruit from Parattah, Tasmania.
D. Anthers.
E. Large juvenile leaf.

Oil.—The leaves yield 1½ per cent. to 2 per cent. of pale oil, consisting mainly of phellandrene with a little pinene and cineol and the peppermint ketone. It resembles the oil of *E. dives*, but has less piperitone and more pinene. The fibrous bark is used for tying.

Timber.—The timber is pale, usually splits readily, does not stand well in the ground, but is easily worked and can be used for furniture and indoor work. The tree re-establishes itself readily by natural regeneration from seedlings and coppices freely from the stump when cut.

It was formerly included under *E. amygdalina* and bears a close relationship to the variety *numerosa* of that species.

Eucalyptus gigantea, Hook.f. (*E. delegatensis*, R. T. Baker). "Red Mountain Ash.) (Plate CLXXX.)

Description.—A very tall tree, 100 feet to 250 feet high, and up to 6 feet to 20 feet diameter, with a reddish, stringy, closely matted bark, the branches and upper portion of the trunk smooth and glaucous, bluish-grey or whitish. Leaves often 9 inches long and 2 inches broad, lanceolate and curved. The juvenile leaves are broader and more rounded or even orbicular. The flowers are in clusters, six to ten on axillary peduncles about six lines long. Buds clavate about six to seven lines long. Thalamus tube short on a pedicel of three to four lines. Operculum hemispherical. Stamens all fertile, anthers reniform, opening by transverse pores. Fruit pear-shaped, four lines long.

Habitat.—A native of North-East Victoria, at Mount St. Bernard, Mount Baw Baw, Dargo High Plain to Delegate; also in Tasmania and New South Wales.

Oil.—The leaves yield 1½ per cent. to 2 per cent. of yellow oil, consisting mainly of phellandrene with a little peppermint ketone and possibly a trace of cineol and pinene.

Timber.—Pale greyish-yellow, light, tough and strong, but easily worked, and moderately figured, resembling oak. Suitable for furniture, joinery, shafts, oars, tool-handles, cabinet work, panels, 3-ply, also for general saw-milling, beams and girders. A cubic foot weighs 40 lb. to 45 lb. when dry and 50 lb. when air-dry. Transverse breaking stress (3 ft. x 3 in. x 3 in.), 3,000 lb. to 7,000 lb. The stem is usually tall, clean, straight and sound, even in old trees. The wood splits freely but is not very durable in the ground. If creosoted it can be used for sleepers. A very valuable timber tree. Usually at elevations of over 2,000 feet to 3,000 feet and hence with regular and prominent annual rings. Of rapid growth, and seeds freely, but natural regeneration often fails. It may attain a height of 40 feet in six years, and of 140 feet in 96 years. It is mature at about 90 years, then yielding some 5,000 superficial feet of timber. It is fit to cut at 40 to 50 years, then having a girth

Plate CLXXXI.—*Eucalyptus Consideniana*. The Yertchuk.

A. Juvenile leaves.
B. Flowering twig.
C. Fruits.
D. Fruits.

of about 7 feet. It is closely allied to messmate (*E. obliqua*) and often succeeds it in more alpine elevations. Although superior to messmate for timber, the tree is less resistant to fire and injurious agencies, excepting frost and snow falls. If severe fire follows three to five years after an area has been ring-barked or clear-felled, it may fail to re-establish, but it is less easily killed out by fire than *E. regnans* and re-afforests readily by seedlings if protected.

Eucalyptus Consideniana, Maiden. "Yertchuk." (Plate CLXXXI.)

(Named after Surgeon Considen who first extracted and used Eucalyptus oil from the Peppermint Gum.)

Description.—A medium-sized tree, 50 feet to 100 feet high, and up to 2 feet diameter, with a fibrous grey tough "peppermint" bark to the smaller branches. Young branches glaucous. Leaves up to 9 inches long and 2 inches broad, lanceolate, usually oblique and falcate, hanging more or less vertically and rather thick. Seedling leaves opposite, shortly stalked in pairs, broadly or narrow lanceolate, often with a wavy margin and small tufts of hairs, but soon becoming alternate, often silvery and with a smell of peppermint. Branchlets and seedling stems angular. Flower buds clavate. Operculum hemispherical, often pointed. Thalamus tube tapering into a short stalk. Anthers reniform. Fruits usually pear-shaped often nearly conical, ¼ inch or more in diameter the valves often well sunk below the usually red and prominent rim, but sometimes projecting.

Habitat.—A native of East Victoria, at Dead Horse Creek, Swan Reach, Tambo Valley, Delegate River, &c., usually in poor sandy, rocky or clayey silurian soils at low elevations, but also on porphyries, quartz grits or conglomerates on mountain sides; also in New South Wales. The tree may possibly be a natural hybrid between *E. dives* and *E. macrorrhyncha*, and it shows a great range of variations in the fruits from the dives to the macrorrhyncha type, and the seedling leaves are similar to those of *E. macrorrhyncha*.

Oil.—According to Baker and Smith the leaves yield 1.2 per cent. of pale brown oil, containing about 40 per cent. of cineol, with pinene, eudesmol, sesquiterpene, and a little phellandrene. According to Drew, Green, and St. John, the oil yield is 0.5 to 1 per cent. and it consists mainly of phellandrene and aromadendrene with about 10 per cent. of cineol and small amounts of aromadendral.

Timber.—Pale, with numerous circular gum veins, but not very hard or durable, and often poor in quality and of little value. A cubic foot when seasoned weighs 55 lb. to 58 lb. Transverse breaking stress of the best quality (3 ft. x 3 in. x 3 in.), 7,000 lb. to 9,000 lb. It is useful for building construction, fence rails, &c. It is a somewhat shy seeder but the adult tree stands ordinary bush fires well. The burnt wood

Plate CLXXXII.—*Eucalyptus pauciflora.* The White Sallee.

1. An unexpanded flower, the lid lifted.
2. Longitudinal sections of unexpanded flowers.
3 and 4. Front and back view of an anther with part of the filament.
5. Stamens *in situ*.
6. Style and stigma.
7 and 8. Longitudinal and transverse section of fruit.
9 and 10. Sterile and fertile seeds.

Beneath the flowering branch, a juvenile leaf is shown in outline.

leaves a cream-coloured ash. The gum veins are often the result of bush fires which have passed over the tree, but also result from mechanical and insect injuries.

Eucalyptus pauciflora, Sieber. (*E. coriacea*, A. Cunn.)* "White Sallee."
(Plate CLXXXII.)

Description.—A tall tree, 60 feet to 100 feet high, with a smooth whitish deciduous bark, the inner layers thick, brittle, and succulent. Leaves 3 inches to 7 inches long, shortly petiolate, acuminate, lanceolate, usually falcate, thick, smooth and shining, sometimes glaucous, main veins parallel or nearly so. Juvenile leaves broadly ovate or nearly circular, paired and almost sessile. Flowers white, five to ten together on axillary peduncles. Thalamus tube very open and about three lines in diameter. Operculum hemispherical, obtuse or nearly conical, shorter than the thalamus tube. Stamens numerous, two to three lines long, anthers small reniform. Fruits pear-shaped, nearly sessile, three to four lines diameter, the capsule slightly sunk, and the valves hardly protruding.

Habitat.—A native of South-West, South, North-East, and East Victoria, at Creswick, Eltham, Buchan, Beaufort, Omeo, Delegate, at elevations up to 5,000 feet but also at low levels; also in South Australia, New South Wales, and Tasmania.

Oil.—The leaves though coriaceous are fairly succulent and are eaten by stock when fodder is scarce. They contain about 1 per cent. of tannin and 0·4 per cent. to 0·5 per cent. of pale brown oil consisting largely of phellandrene with a little cineol, peppermint ketone, pinene, eudesmol and sesquiterpene.

Honey.—Clear, transparent, golden in colour, of medium density. Bees gather the pollen. Flowering profuse but irregular.

Timber.—The wood is pale, rather soft, usually with many gum veins, and shrinks considerably on seasoning. Unless slowly seasoned it is apt to warp and is not in the first rank as a timber. It rarely lasts well in the ground but can be used for fence rails and firewood, and for posts if the well-seasoned butt is used. The variety *alpina* is simply a small leaved, shrubby alpine form growing up to an elevation of 6,000 feet.

niphophila

Eucalyptus pauciflora, Sieb. var. *alpina*, "Snow Gum."

Description.—A tall shrub or small tree up to 15 feet or rarely 20 feet high. Leaves short and nearly straight, smaller than the ordinary form and more or less glaucous. Flowers white, small on short peduncles. Fruit nearly sessile, pear-shaped, three to four lines diameter, with a broad rim and sometimes slightly angular.

* Maiden (Crit. Rev. Gen. Eucalyptus, Vol. 1 part V. p. 133) adopts the later name of E. coriacea, partly on the ground that it is more appropriate. This is, however, not a valid reason for changing an established prior name.

Plate CLXXXIII.—*Eucalyptus regnans.* The White Mountain Ash.

A. Seedling.
B. Flowering twig.
C. Two umbels of buds.
D. Portion of leaf, showing oil dots.
E. Fruits fully ripe.
F. Fruits hardly ripe.

Habitat.—A native of South, North-East, and East Victoria, on Mount St. Bernard and Mount Feathertop, ascending in the Alps to over 4,000 feet to 5,000 feet where it forms rather extensive woods with a large amount of bare stem and the foliage all at the top in one level. It is an important agent in checking avalanches of snow; it is resistant to cold, and grows readily from seed.

Timber.—Usually too small to be of economic value except for firewood.

Oil.—The oil is similar to that of the type form but contains more phellandrene and less pinene and the yield is greater (0.7 per cent. to 0.8 per cent.)

Eucalyptus regnans, F.v.M. " White Mountain Ash." (Plate CLXXXIII.)

Description.—A tall straight tree 200 feet to 326 feet high with a smooth whitish bark, occasionally brown and fibrous at the extreme base. Leaves 2 inches to 4 inches long, lanceolate curved, rather thin with numerous pellucid oil dots. Seedling leaves opposite, sessile, rounded-cordate to broadly lanceolate with a whitish waxy bloom. The seedling later resembles that of *E. obliqua*. Flowers small, four to eight together on solitary or rarely paired axillary peduncles. Thalamus tube nearly hemispherical but tapering into the pedicel. Operculum hemispherical to conical. Stamens numerous, two lines long, reniform. Fruit sub-globose-truncate or semi-ovate, under three lines diameter, the valves usually projecting and the rim depressed.

Habitat.—A native of East Victoria, in the Otway district and Yarra Ranges, in Gippsland at Fish Creek, &c., also in the North-Eastern ranges, usually on moist slopes and hill-sides on good soil or volcanic or mesozoic carboniferous formations at elevations of 500 feet to 2,500 feet; also in Tasmania and New South Wales.

Oil.—Owing to the height of the tree and its valuable character the leaves are not used for oil, but it is abundant, is red in colour when first distilled, and consists mainly of phellandrene and eudesmol with sesquiterpene, geraniol, and a trace of cineol.

Timber.—The timber has fairly large pores as in messmate (*E. obliqua*), but is paler with prominent annual rings, free from gum veins and not very durable in the ground. It is straight in grain, moderately hard, splits easily, seasons well, particularly if cut on the quarter, and is one of the most useful hardwoods, equal to the best ash, oak, or hickory for flooring, furniture, beams, planks, shingles, and weatherboards. The latter require oiling where exposed to the weather. A cubic foot weighs 40 lb. to 50 lb. when air dry, 63 lb. green, and 37 lb. completely dry. Transverse breaking stress (3 ft. x 3 in. x 3 in.) 4,000 lb. to 5,500 lb.

Plate CLXXXIV.—*Eucalyptus Sieberiana.* THE SILVERTOP.

1. Upper portion of calyx, the lid lifted.
2. Longitudinal section of a flower bud.
3 and 4. Front and back view of an anther.
5. Sterile and fertile stamens *in situ.*
6. Style with stigma.
7. Longitudinal section of fruit.
8. Transverse section of fruit.
9 and 10. Sterile and fertile seeds.
11. Embryo uncoiled.
12. Embryo in its natural position.

Special Data.—The medullary rays remain living for over 100 years, and in natural forest where the young trees grow under great shade the central corewood is often very soft and only partially lignified. It is best cut at 60 to 80 years and during winter. When large trees are felled, the strains set up during felling often cause large cracks to open in the wood. These have nothing to do with loss of moisture. It is very sensitive to bush fires, and after severe fire fails to re-establish itself by natural regeneration. When cut the stump dies without forming coppice growth.

The supposed records of 400 feet and over were exaggerations not based on exact measurement. (See Ewart, Proc. Roy. Soc., London, 1908, Vol. 199, p. 362).

Few trees now exceed 200 feet to 250 feet. The maximum heights ranged from 270 feet to 326 feet. A record of 302 feet due to the late Professor Kernot, was of a tree accurately measured in the Dandenong Ranges but later destroyed by fire. A record of 374 feet, which was a tree measured by G. Cornthwaite, a licensed surveyor, in 1880, near Thorpdale, Gippsland (Hardy, Vict. Nat. 1923, p. 166), was not reported while the tree was still in existence, and may be a memory error for 314 feet. These trees of over 300 feet are no longer living. The early growth in height is very rapid and the trunk straight with little or no taper. The tree is fit to cut for timber at 40 to 50 years. It appears to be fully matured at 70 to 90 years. After 100 years the central core-wood is apt to become soft or rotten. Few trees appear to exceed 200 years in age in spite of their giant size. In timber production per acre it is one of the closest rivals among the hard woods to conifers among soft woods. In seasoning the wood shrinks 5 per cent. radially, 8 per cent. tangentially, and 2 per cent. in length. It seasons well both naturally and in kilns.

Eucalyptus Sieberiana, F.v.M. "Silvertop." (Plate CLXXXIV.)

Description.—A tall tree 80 feet to 150 feet high and 2 feet to 4 feet in diameter, with a deeply furrowed dark brown bark, somewhat approaching an ironbark, but softer and less corrugated, the smaller branches with smooth often reddish or purplish glaucous bark. Leaves 4 inches to 6 inches long by 1 inch wide, coriaceous, oblique or more or less falcate. Seedling leaves large, glaucous and glabrous, paired and sessile, in one vertical row. Flowers several together on rather long pedicels, the peduncle flattened. Thalamus tube nearly hemispherical, buds clavate. Operculum hemispherical or slightly umbonate, sometimes double. Stamens about three lines long, the outer ones sterile. Anthers reniform. Fruit narrow, pear-shaped, four to six lines long, shining and usually with a well defined dark-red rim.

Habitat.—A native of North-East and East Victoria, mostly at elevations over 1,000 feet and up to 5,000 feet on the Buffalo Ranges, on ridges along the Ovens Valley and in Gippsland. Also in New South Wales and Tasmania, usually on rocky mountain ranges with poor granite sandstone or slaty soil and often confined to the southern slopes. On richer soils at low elevations it is of very rapid growth but produces inferior timber. The aboriginal name in Gippsland is " Yuwut."

Oil.—The leaves yield 0.3 per cent. to 0.5 per cent. of pale oil, consisting mainly of phellandrene with a little peppermint ketone, cineol (5 per cent. to 10 per cent.), and pinene.

Timber.—The wood is a pale brown but rather darker than that of *E. regnans* and *E. gigantea* and often marked by dark spots. It splits readily, is hard and usually free from gum veins, but is not very durable in the ground or where exposed to the weather. It is however valuable for furniture, flooring, planks, beams, rafters, spokes, and naves of wheels, poles, and shafts of drays, &c. A cubic foot weighs 51 lb. to 54 lb. dry and 54 lb. to 57 lb. when air-dry. Transverse breaking stress (3 ft. 3 in. x 3 in.), 6,000 lb. to 8,500 lb. The preservation of this tree is of importance in maintaining water supply areas and in preventing mountain erosion and floods. Where it grows at elevations of over 2,000 feet, it is so valuable for this purpose that it is doubtful whether cutting of it should ever be permitted except under most rigid control. Frequently it only forms seed abundantly every two or three years, and as it is rather sensitive to bush fires may fail to regenerate if the fire falls in a bad seeding year. White ants attack it very readily when growing at low elevations on rich soils, and old trees are often piped.

LEPTOSPERMUM.

A genus of about 30 species, all Australian with the exception of three which occur in Malaysia and one (*L. ericoides*) which is endemic to New Zealand. The Australian *L. scoparium* also extends to New Zealand. Shrubs or small trees with small spirally arranged leaves, the flowers occurring singly in the axils of the leaves and on short stalks. The thalamus is a flat cup not wholly united with the ovary. Stamens fairly numerous, shorter than the petals, somewhat incurved, often clustered in groups opposite the petals. Style short. Stigma capitate. Numerous ovules arising from a shield-shaped placenta.

The leaves of several species have been used as a substitute for tea. Though small the wood is usually hard and tough. That of the Molluccan *L. amboinense* is very hard and is used for tool handles, carving, and turnery. All the *Leptospermums* flower freely and produce much nectar. The honey is very dark with a rank flavour and sets to a jelly in the comb, so that it can only be extracted by pressure or warming. After heating

Plate CLXXXV.—*Leptospermum laevigatum.* The Coast Tea-tree.

A. Flowering branch.
B. Fruiting branch.
C. Flower from above.
D. Flower from side.

obovatum

Plate CLXXXVI.—*Leptospermum flavescens*. THE TANTOON.

A. Flowering branch.
B. Fruits.
C. Flower from side.
D. Flower from above.
E and F. Front and back of anther.
G. Fruit from above.

it is apt to candy coarsely. Although not a table honey, it, together with the pollen, forms good winter food for bees. The seeds though small may retain the power of germination for five to ten years. A sixteen-year-old sample of *L. scoparium* still gave 2 per cent. germination.

Leptospermum laevigatum, F.v.M. "Coast Tea-tree." (Plate CLXXXV.)

Description.—A tall shrub or even small slender tree 15 feet to 30 feet high. Leaves oblong-ovate to oblong, cuneate, mostly $\frac{1}{2}$ inch to $\frac{3}{4}$ inch long, three nerved. Flowers white axillary, solitary, sessile or nearly so, rarely two together on a very short peduncle. Calyx glabrous, the sepals finally falling. Ovary usually ten-celled, sometimes fewer, five or even four. Style short. Stigma broadly peltate. Capsule almost flat-topped, not very hard. Fertile seeds, rather broad, winged at the angles. It usually flowers in September and October.

Habitat.—A native of North-West, South-West, South and East Victoria, on the coast at Port Phillip, &c.; also in New South Wales, Tasmania and South Australia, usually near the coast and a useful wind break and sand stay.

Timber.—Tough, close-grained, light coloured, but darker towards the centre. Useful for light poles, stakes, trellis for peas or climbers and for firewood.

Leptospermum flavescens, Smith. "Tantoon." (Plate CLXXXVI.)

Description.—Usually a tall shrub, sometimes 15 feet to 20 feet high, nearly glabrous. Leaves from narrow oblong or linear lanceolate to broadly oblong or even obovate, one to three nerved. Flowers solitary, sessile. Calyx quite glabrous with obovate lobes. Thalamus tube broadly campanulate or hemispherical. Petals white or slightly yellowish. Ovary five-celled, somewhat convex on top, with a small central depression around the style. Capsule hard, the valves projecting beyond the thalamus tube. Seeds narrow linear.

Habitat.—A native of North-West, South-West, South, North-East and East Victoria, usually in inland localities, Buffalo Ranges, along the Yarra, Goulburn and Ovens Rivers, &c.; also in New South Wales, Queensland, South Australia, and Tasmania.

Timber.—Tough, close-grained, light coloured, but darker towards the centre. Useful for light poles, stakes, trellis for peas or climbers and for firewood.

BOTANIC & DOMAIN GARDENS

Plate CLXXXVII.—*Leptospermum lanigerum.* The Woolly Tea-tree.

A. Flowering shoot.
B. Flower (side view).
C. Flower (from above).
D. Fruit enclosed by calyx.
E. Surface view of dehiscing fruit.

Leptospermum lanigerum, Smith. "Woolly Tea-tree." (Plate CLXXXVII.)

Description.—A tall, erect shrub, 10 feet or even 20 feet high, and up to 6 inches in diameter, with soft spreading hairs. Leaves usually $\frac{3}{4}$ inch long, obovate to narrow elliptical. Flowers white, solitary, but close together on the branches, sessile, rather large, usually opening from October to February, according to the locality. Sepals five, short, obtusely pointed. Petals, five, free, white, orbicular, shortly-stalked. Stamens 20 to 30, free, but arising from a common basal ring. Ovary five-celled. Capsule hard, globular, three to four lines diameter, the valves protruding. Seeds linear, but winged.

Habitat.—A native of North-West, South-West, South and North-East Victoria, usually in mountainous inland districts, but also in the neighbourhood of Melbourne and around Port Phillip; also in New South Wales, Queensland, South Australia, and Tasmania.

Timber.—Tough, close-grained, light coloured, but darker towards the centre. Useful for light poles, stakes, trellis for peas or climbers and for firewood. A cubic foot averages 50 lb. when air-dry.

Leptospermum attenuatum, Sm. "Slender Tea-tree." (Plate CLXXXVIII.)

Description.—A tall shrub 12 feet to 15 feet high. Leaves $\frac{1}{4}$ inch to 1 inch long, one to three nerved, flat, lanceolate to almost linear. Flowers on short stalks, small. Sepals with shining greyish hairs outside. Thalamus tube hairy. Ovary sunk in the thalamus. Capsule with its valves scarcely prominent above the rather soft thalamus tube, calyx lobes persistent.

Habitat.—A native of North-East and East Victoria, along the Avon, Mitta Mitta, Ovens and other rivers in Gippsland; also in New South Wales and Queensland.

Timber.—Tough, close-grained, light coloured, but darker towards the centre. Useful for light poles, stakes, trellis for peas and climbers and for firewood.

KUNZEA.

A genus of some 20 species, closely related to *Leptospermum* and forming a transition to *Callistemon*. All the species are Australian, but none occur in North Australia.

Kunzea is distinguished from *Leptospermum* by the stamens being longer than the petals and from *Melaleuca* by the stamens being free instead of united in bundles, while in *Callistemon*, which has also long free stamens, the sepals are deciduous instead of persistent as in *Kunzea*.

Plate CLXXXVIII.—*Leptospermum attenuatum*. The Slender Tea-tree.

A. Flowering shoot.
B. Flower from the side.
C. Flower from above.
D. Leaf and young fruit from side showing the sepals, with older dehiscing fruits from above showing the valves.

Plate CLXXXIX.—*Kunzea peduncularis*. The Burgan.

A. Flowering branch.
B. Leaf.
C. Single flower.
D. Fruiting twig.
E. Single fruit (front view).

ambigua

Plate CXC.—*Kunzea corifolia*. THE WHITE KUNZEA.

A. Flowering branch.
B. Fruiting branch.
C. Flower.
D. Flower from above.
E. Fruit from above.
F. Leaf.

Flowers axillary, in clusters, through which the axis may continue to grow. Thalamus tube bell-shaped, with the two to five-chambered ovary deeply sunk in it. Sepals persistent, often with a membranous edge. Stamens numerous, mostly longer than the petals.

Kunzea peduncularis, F.v.M. "Burgan." (Plate CLXXXIX.)

Description.—A tall shrub or sometimes a small tree 15 feet to 20 feet high, and nearly 6 inches in diameter. Leaves ½ inch to nearly 1 inch long, linear to elliptic lanceolate. Flowers small, shortly pedicellate, solitary or two or three together. Calyx about one and a half lines long. Petals five, one line long, white. Stamens above 30, filaments white. Ovary three to five celled, about half as long as the thalamus tube. Fruit capsular with a slightly enlarged thalamus and usually one perfect seed in each cell.

Habitat.—A native of South North-East and East Victoria, along the Snowy and MacAlister Rivers; also in New South Wales and Queensland and often grown in gardens.

Timber.—Usually too small to be of economic value.

ambigua

Kunzea corifolia, Reich. "White Kunzea." (Plate CXC.)

Description.—A tall shrub 10 feet to 15 feet high, sometimes nearly 6 inches in diameter, glabrous or the young shoots slightly pubescent. Leaves ¼ inch to ½ inch long, linear to narrow lanceolate. Flowers white. nearly sessile and numerous along the main branches. Petals five, one line diameter, white. Stamens numerous, filaments white. Ovary three-celled, ovules numerous in each cell. Fruit with a somewhat enlarged thalamus, almost dry, the sepals persisting.

Habitat.—A native of East Victoria, along the Genoa River, on Glenny Islands, and the coast of Wilson's Promontory; in New South Wales and Tasmania, usually near the coast.

Timber.—Too small to be of economic value.

CALLISTEMON.

A wholly Australian genus of twelve or so shrubs or small trees, with more striking and beautiful flowers than *Kunzea* or *Melaleuca*, and widely grown in gardens. Flowers in spikes through which the axis grows. Sepals membranous and deciduous. Stamens numerous, usually in two rings, longer than the petals and often bright red. Style very long. Stigma simple or button like. Ovary three to four-chambered, united basally with the thalamus, velvety on top. Seeds numerous. Fruits capsular. The fruits often persist, particularly under moist conditions, on the stems for years with unshed seed, until after severe drought or a

Plate CXCI.—*Callistemon lanceolatus*. The Crimson Bottlebrush.

A. Part of a branch showing flowers, persistent fruits and foliage.
B. Flower.
C. Individual flower with petals removed to show free stamens.
D. Stamen.

bush fire, or after the excision of the branch, when the fruits open and the seeds are shed. The seeds may give good germination for five to ten years. Thus a five-year-old sample of *C. rigidus* gave 19 per cent. and a 22-year-old sample 3 per cent. germination. In one case a sixteen-year-old sample of *C. lanceolatus* gave 75 per cent. germination. In the soil, however, the seeds do not appear to last nearly as long as on the tree or when kept dry. Apart from the varying colour of the stamens, the floral characters are much alike in the different species of this genus.

Callistemon lanceolatus, D.C. "Crimson Bottlebrush." (Plate CXCI.)

Description.—Usually a tall shrub, 10 feet to 15 feet high, but sometimes a small tree 20 feet to 30 feet high. Leaves 1½ inches to 2 inches long, but often 1 inch to 3 inches, lanceolate and flat. Flower spikes red, 2 inches to 4 inches long. Thalamus tube cup shaped, projecting slightly inwards at the middle over the ovary. Sepals five, about less than one-third of the length of anthers, obtuse. Petals small, green or reddish. Stamens numerous, in two rings, the filaments usually bright red, the anthers dark-coloured. Thalamus not much enlarged in fruit. Ovary three-celled, axile placentation with numerous ovules.

Habitat.—A native of East Victoria, in Eastern Gippsland; also in New South Wales and Queensland.

Timber.—Pale brown, hard, heavy, close-grained, tough. Can be used for tool handles, but too small to be of much economic value.

Callistemon rugulosus, D.C. (*C. coccineus*, F.v.M.) "Scarlet Bottlebrush." (Plate CXCII.)

Description.—Usually a tall shrub 10 feet to 15 feet high. Leaves 1 inch to 1½ inches long, rigid, usually narrow lanceolate. Flowers crowded in the spikes. Sepals small, five, bluntly pointed, barely united at the base. Petals five, two to three lines diameter. Stamens numerous, ¾ inch to 1 inch long, red filaments and yellow anthers, style long, slender, stigma small, discoid. Fruits in dense spikes.

Habitat.—A native of North-West Victoria, on the Grampians; Also in New South Wales and South Australia.

Timber.—Too small to be of economic value.

Callistemon salignus, D.C. "Willow Bottlebrush." (Plate CXCIII.)

Description.—A tall shrub or small tree, 20 feet or even 40 feet high. Leaves 1 inch to 2 inches long, broad-linear to narrow lanceolate, flat. Flowers somewhat distant in the spikes. Petals, five, almost globose. Stamens numerous, in two rings, ½ inch long, filaments, pale yellow or rarely light pink or purplish, anthers yellow. Style long, slender. Thalamus not much enlarged in fruit.

Plate CXCII.—*Callistemon rugulosus.* The Scarlet Bottlebrush.

A. Flowers and fruits from previous flowering.
B. Fruit.
C. Flower.
D. Transverse section of ovary.

Plate CXCIII.—*Callistemon salignus*. The Willow Bottlebrush.

A. Flowering twig.
B. Fruits.
C. Flower.
D. Flower opened out.
E. Transverse section through ovary.

Plate CXCIV.—*Callistemon Sieberi.* The Alpine Bottlebrush.

A. Flowering branch.
B. Branch with fruits.
C. Flower.
D. Section of flower.
E. Ripe fruit.
F. Young fruit.

Plate CXCV.—*Callistemon paludosus*. The Swamp Bottlebrush.

A. Flowering branch.
B. Fruiting branch.
C. Section of flower.
D. Young fruit.
E. Ripe fruit.

Habitat.—A native of North-West, South-West, South, North-East and East Victoria, common on the Yarra, Ovens, Goulburn and other rivers; also in New South Wales, Queensland, South Australia and Tasmania, up to alpine elevations.

Timber.—Pale, brown, hard, tough, with a close interlocked grain. Although not very abundant or large, its timber is one of the hardest Australian woods, useful for turnery, tool handles, wooden cogs, mauls, &c. The tree is, however, rather slow in growth, but is easily raised from seed.

Callistemon Sieberi, D.C. "Alpine Bottlebrush." (Plate CXCIV.)

Description.—A tall shrub or small tree 10 feet to 20 feet high. Leaves linear, ½ inch to ¾ inch long, hardly narrowed to a petiole. Flowers small, sessile on the axis, in rather short spikes, ultimately prolonged as leafy shoots. Sepals five, free, short, obtusely pointed. Petals five, orbicular. Stamens numerous in two rings, filaments pale yellow or light pink. Thalamus not much enlarged in fruit. Fruits clustered and persistent on the axis.

Habitat.—A native of North-East Victoria, in the Australian Alps; also in New South Wales.

Timber.—Pale brown, hard, tough. Usually too small to be of economic value, but can be used for tool handles.

Callistemon paludosus, F.v.M. "Swamp Bottlebrush." (Plate CXCV.)

Description.—A tall shrub or small tree, 15 feet to 30 feet high, but often not more than 4 feet to 6 feet. Flower rather scattered and axillary. Leaves 1 inch to 4 inches long, linear to lanceolate pointed, narrowed at the base to a petiole. Sepals very small, free. Petals about three times as large, five, free, obtuse, soon falling. Stamens numerous, pale yellow. Thalamus not much enlarged in fruit. Fruits persistent, rather scattered.

Habitat.—A native of North-East Victoria, on the Buffalo Mountains; also in New South Wales, South Australia, and Tasmania, in wet or swampy places.

Timber.—Pale brown, tough, not quite so hard as the preceding timber, but can be used by wheelwrights and for cabinet work.

MELALEUCA.

A genus of over 100 species of shrubs or trees, all Australian with the exception of *M. Leucadendron* which extends through Malaysia to the Philippines. The leaves and flowers are usually smaller than in *Callistemon*. Flowers solitary or in terminal or intercalary spikes, rarely in

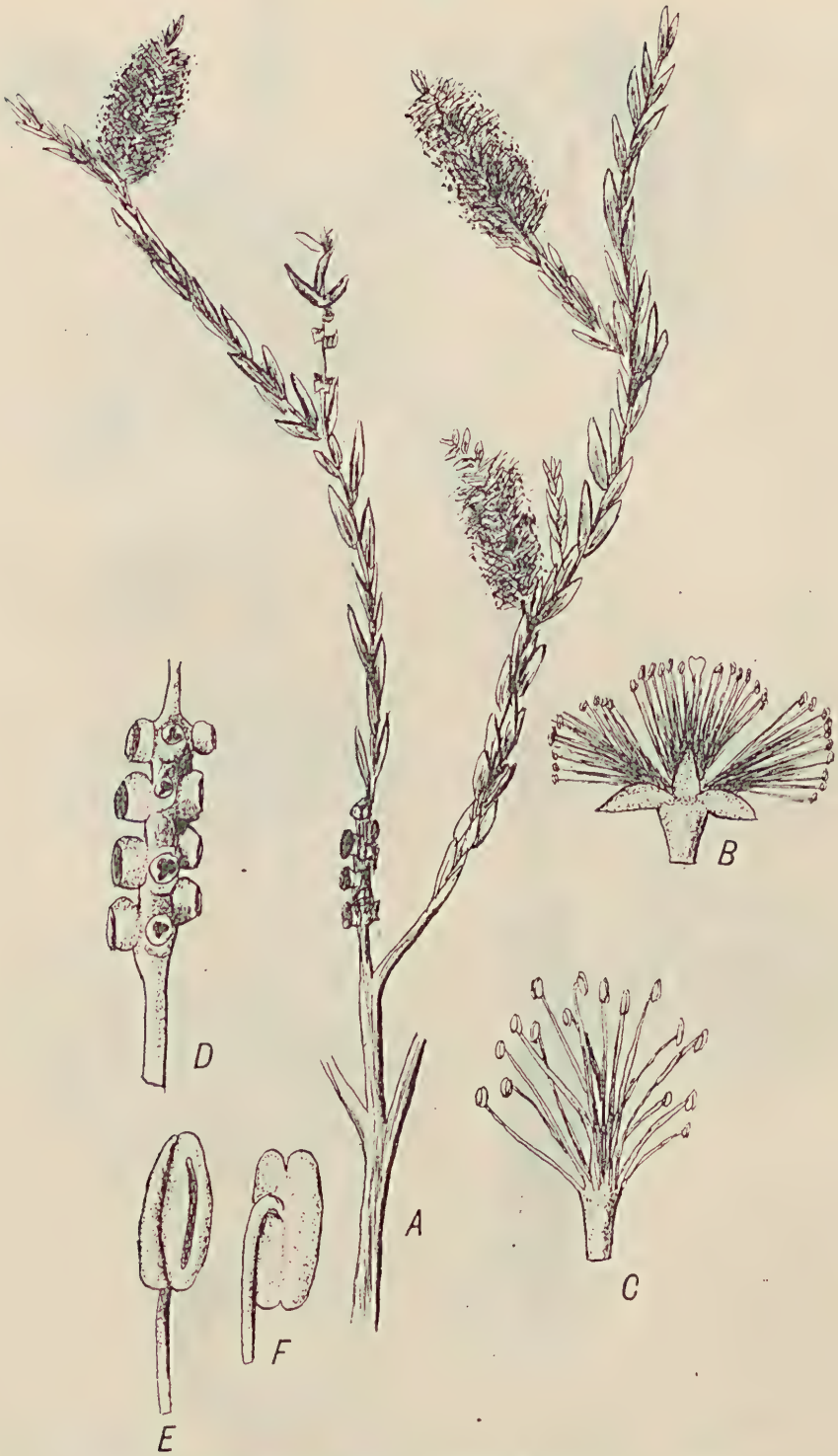

Plate CXCVI.—*Melaleuca decussata.* The Cross-leaf Honeymyrtle.

A. Branch with flowers and persistent fruits.
B. Single flower.
C. Cluster of stamens.
D. Persistent fruits.
E and F. Side view and back view of anther.

Plate CXCVII.—*Melaleuca armillaris.* The Bracelet Honeymyrtle.

A. *Melaleuca armillaris.*
B. Flower.
C. Flower opened out.
D. Fruit.
E. Stamen, face view.
F. Stamen, back view.
G. Section of ovary

Plate CXCVIII.—*Melaleuca ericifolia.* The Swamp Paper Bark.

A. Flowering branch.
B. Persistent fruits on axis.
C. Flower.
D. Flower opened out.
E. Stamen, face view.
F. Stamen, back view.

terminal heads. Calyx persistent or falling off with the free part of the thalamus. Stamens united basally in five clusters opposite to the petals. The seeds do not appear to retain the power of germination beyond the third to fifth year.

The wood is hard, heavy, strong, and in the slender stemmed species, tough and elastic enough for use as fishing rods, light poles, &c. The boiled extracts from the leaves or fruits ("ballong") of several species are used as tonic or stomachic medicines. Most yield oil on distilling, but the yield is usually small (under 0·1 to 0·2 per cent.), and the oils vary in composition, many resembling different Eucalyptus oils. *M. Leucadendron* var. *cajeputi* yields Cajeput oil consisting mainly of cineol with some terpenes and aldehydes. The bark is usually in thin lamellated papery layers and is used for ship caulking. The timber is very durable in water and can be used for making corduroy or brush roads across swamps or wet places. It is brown to reddish-brown, somewhat like a pale walnut. It averages 40 lb. to 50 lb. per cubic foot when seasoned and has a transverse breaking stress (3 ft. x 3 in. x 3 in.) of 5,000 lb. to 6,000 lb. When large enough it is useful for cabinet work.

Melaleuca decussata, R.Br. "Cross-leaf Honey-myrtle." (Plate CXCVI.)

Description.—A tall glabrous shrub, 15 feet to 20 feet high. Leaves opposite, ¼ inch to ½ inch long, one or three nerved, in four close rows. Flowers in heads or short spikes. Sepals small. Petals five. Stamens in bundles of ten to fifteen, usually under three lines long, the filaments purplish lilac and united only at the extreme base. Ovary sunk. Ovules numerous. Fruits sunk in the branches.

Habitat.—A native of North-West and South-West Victoria, at Portland and on the summit of Mount William and other Grampian Mountains; also in South Australia.

Timber.—Too small to be of economic value.

Melaleuca armillaris, Sm. "Bracelet Honey-myrtle." (Plate CXCVII.)

Description.—A tall glabrous shrub or sometimes a small tree, 15 feet to 20 feet high. Leaves alternate ½ inch or more long, narrow to broadly linear. Flowers white. Sepals small, persistent. Petals five, above one line long. Stamens several times longer than the petals, three to four lines long, the filaments pale, pinnately arranged at the ends of the common stalks. Ovary enclosed by thalamus tube and later fusing with it. Ovules numerous in each cell. Style very long and narrow. Flower spikes cylindrical, not very dense. Fruit slightly broader than long, not much contracted, but lobed at the orifice.

Plate CXCIX.—*Melaleuca parviflora.* The Moonah.

A. Branch with flowers and persistent fruits.
B. Flower cut open.
C. Flower.
D. T.S. ovary.
E. Anther (back view).
F. Anther (face view).
G. Fruit.

Habitat.—A native of East Victoria, common on river banks, mostly at the south eastern extremity of the State; also in New South Wales and Queensland.

Timber.—Usually too small to be of economic value.

Melaleuca ericifolia, Sm. "Swamp Paperbark." (Plate CXCVIII.)

Description.—A shrub or tree, 10 feet to 25 feet high and 1 foot to 2 feet diameter with virgate branchlets. Leaves alternate, usually under ½ inch long, narrow to broad linear. Flowers yellowish-white, or rarely red, not large. Petals five, about one line long. Usually seven stamens in each bundle. Stamens united in five bundles, each on a common stalk, three to four lines long, the filaments pale, anthers versatile. Ovary enclosed within thalamus tube, and later fusing with it. Ovules numerous in each cell. Fruiting spikes compact, fruits scarcely longer than broad, lobed at the orifice.

Habitat.—A native of South-West, South, North-East and East Victoria, on the Yarra and Goulburn Rivers, on the Dandenongs, &c.; also in New South Wales, Queensland, South Australia, and Tasmania, usually in swampy ground.

Timber.—Brown, close-grained, useful for cabinet work when of sufficient size. A cubic foot averages 47 lb. to 50 lb. when air-dry.

Melaleuca parviflora, Lindl. "Moonah." (Plate CXCIX.)

Description.—A tall shrub or small tree, 15 feet to 25 feet high. Leaves alternate, ½ inch long, linear to narrow lanceolate. Flowers white or yellowish, in spikes 1 inch to 2 inches long. Sepals deciduous. Petals five, one or three-nerved and one line diameter. Stamens in bundles of ten to twelve, three to nearly four lines long, two to three times as long as the petals. Ovary sunk. Fruit longer than broad, contracted at the top, not lobed. Ovules very numerous. Thalamus tube ovoid, thick, one line long.

Habitat.—A native of North-West, South-West, and South Victoria, around Port Phillip, at Bacchus Marsh, on the Murray, &c.; also in New South Wales, Queensland, South Australia and Western Australia, usually on dry ground or near the coast.

Timber.—A cubic foot green weighs 58-64 lb; air dry weighs 34-36 lb. and dry weighs 29-30 lb. The wood is pale when fresh, drying a pale pinkish brown. It is very tough, hard and dense, is apt to develop star shakes but otherwise dries without cracks. The medullary rays are very fine, and the pores and annual rings not prominent, the latter being irregular.

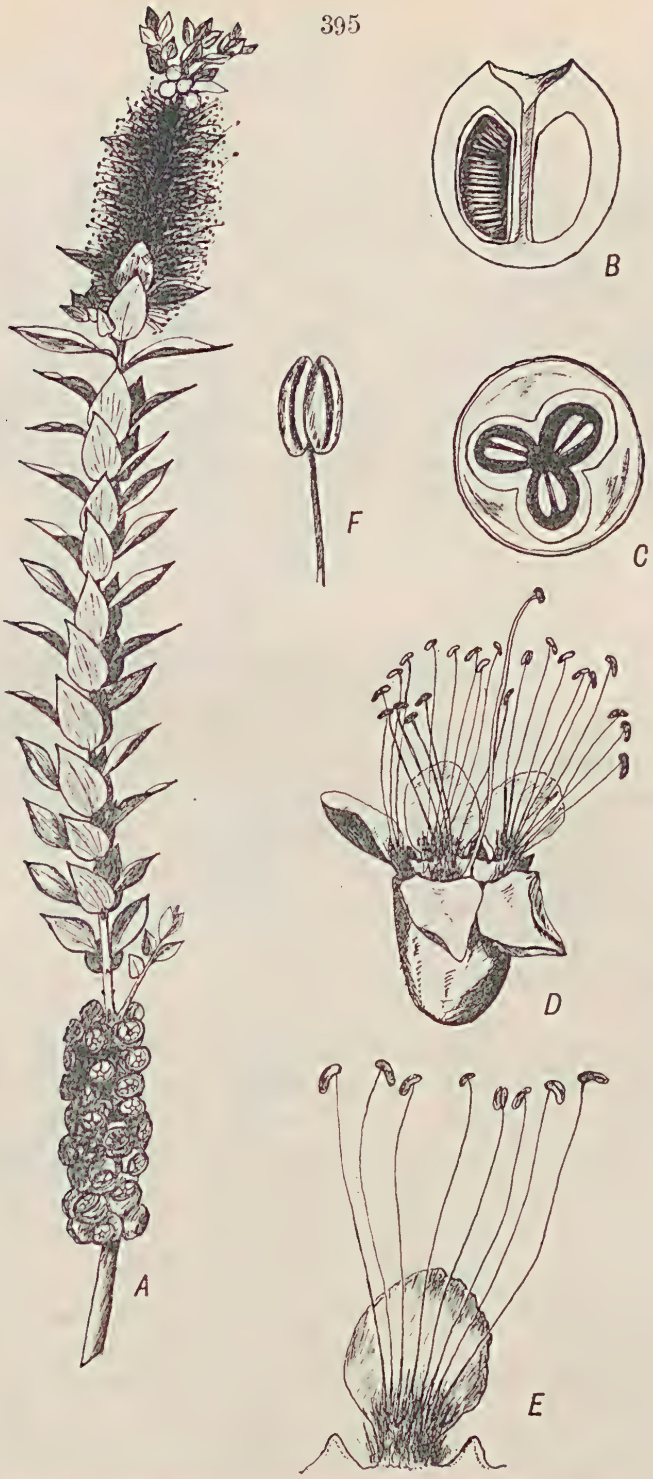

Plate CC.—*Melaleuca squarrosa.* Scented Paper Bark.

A. Spray with flowers and fruits.
B. Longitudinal section of fruit.
C. Transverse section of fruit.
D. Flower.
E. One petal and a group of stamens.
F. Stamen.

Melaleuca squarrosa, Don. "Scented Paperbark." (Plate CC.)

Description.—A handsome erect shrub or tree, 10 feet to 40 feet high, with a pale or white lamellated bark. Leaves opposite, three to four lines rarely ½ inch long, cordate to lanceolate-ovate and pointed. Flowers yellowish-white in dense spikes. Sepals small. Petals five, three lines long. Stamens in bundles of eight to twelve, the filaments pale yellow and shortly united at the base. Ovary three-celled. Fruiting spikes rather dense.

Habitat.—A native of South-West and South Victoria, in marshes along the Yarra, moist heaths on the Glenelg River, at Portland, &c.; also in New South Wales, South Australia and Tasmania.

Timber.—Brown, fairly hard, tough, useful for cabinet work, poles, &c.

ARALIACEAE.

A fairly large order mainly of trees and shrubs of over 50 genera and 450 species, mainly found in the tropics, and, though characterized by its usually large and beautiful foliage, of little economic value. The leaflets of the tropical *Sciadophyllum ferrugineum* reach a length of 2½ feet. Chinese rice paper is obtained from the pith of *Tetrapanax papyrifer*, the rice paper-tree, and from certain species of *Panax* growing in Formosa. The wood is usually too soft to be of value. *Panax ginseng* yields Ginseng root, valued medicinally in China.

Calyx usually small, in the form of a rim or short teeth. Petals five, free, usually with pointed, rarely inflected, tips. Stamens usually five, rarely three or numerous. Ovary usually inferior, generally five-, less commonly three- or two-chambered, rarely with numerous chambers or only one. The flowers are more usually in heads or spikes than in umbels, except in *Hedera helix*, the common Ivy where they form simple umbels. The fruits only rarely split into mericarps. The *Araliaceae* being mainly shrubs and trees are an older order than the herbaceous *Umbelliferae*, which have developed from the *Araliaceae* mainly in temperate regions by fixing a line of characters of which the beginnings are shown in various members of the *Araliaceae*, but not uniformly in all, as they are in *Umbelliferae*. These are (1) reduction of calyx, (2) petals and stamens regularly five, (3) petals with inflected tips, (4) a pronounced disc, (5) ovary completely inferior, (6) fruit two-chambered and splitting into two one-seeded mericarps, (7) flowers in simple or compound umbels. Although the *Umbelliferae*, have not yet developed tree-like forms, some attain a considerable size. *Heracleum* is sometimes 15 feet high.

Plate CCI.—*Tieghemopanax sambucifolius.* Elderberry Panax.

A. Fruit.
B. Flower.
C. Inflorescence.

TIEGHEMOPANAX, R. Viguier.

A large genus of shrubs or trees most abundant in Madagascar and New Caledonia, but a few species extending to Australia. The true *Panax* includes the *Ginseng* and is a genus of herbs with palmately compound leaves in whorls, a two- to three-chambered ovary and the flowers in umbels. *Tieghemopanax* has the calyx rim entire or with short teeth, usually five petals, rarely four to sixteen. Stamens equal in number to petals. Ovary two- to ten-chambered rarely more or only one. Fruit round or flattened. Cocci and seeds laterally compressed. Leaves simply pinnate or bi- or tri-pinnate. Flowers in umbels, heads, racemes or spikes. Flower stalk segmented beneath the flower. Flowers usually polygamous.

The Victorian species have the flowers in umbels and the ovary two or three, rarely four-chambered. Seeds for planting should not be kept or more than a year.

Tieghemopanax sambucifolius (Sieber). Viguier. "Elderberry Panax." (Plate CCI.)

Description.—A tall shrub or small tree 15 feet to 25 feet high, quite glabrous. Leaves simply or doubly pinnate. Leaflets 1½ inch to 3 inches long, ovate-lanceolate to almost linear. Flowers in a panicle or raceme of many-flowered umbels.

Calyx rim shortly prominent and sinuate toothed. Petals in the perfect flowers often cohering at the tips. Stamens five. Fruit two to three lines broad with a white or lead-coloured succulent exocarp.

Habitat.—A native of South, North-East and East Victoria, on mountains from the Dandenongs and Mount Macedon to the Buffalo Ranges, and a great part of Gippsland; also in New South Wales, Queensland and Tasmania.

Timber.—Too small and soft and perishable to be of economic value.

A narrow-leaved variety (var. *angustifolia*) was considered by Mueller to be a distinct species (*Panax dendroides*, F.v.M.). Like the preceding it is a tall shrub almost arborescent and fifteen to twenty feet high and is a native of South and North-East Victoria, throughout the greater part of Gippsland. The timber is too small to be of economic value.

Tieghemopanax Murrayi, (F.v.M.) Viguier. "Large-leaved Panax."

Mueller listed this as a native plant but it is doubtful whether it is indigenous to the State. It is a tree with a straight slender stem, 40 feet to 60 feet high. Leaves simply pinnate. Leaflets 3 inches to 10 inches long. Umbels many-flowered in racemes or panicles. In habit the tree somewhat resembles a palm, being branched sparsely at the top only. Stamens as many as petals. Fruit about two lines broad, the endocarp leathery and bluish.

Plate CCII.—*Leucopogon lanceolatus*. Lance Beard Heath.

A. Flowering spray.
B. Leaves, showing variation in size and shape within the species.
C. Fruit.
D. Flower.
E. Flower showing anthers.
F. Stamen.
G. Section of fruit.

Fairly widely spread in New South Wales and Queensland, usually in moist sheltered localities.

Timber.—Pale, rather soft, not durable, but might be used for linings, paper pulp, match boxes, or the median sheet of 3-ply.

EPACRIDACEAE.

An order of some 20 genera and nearly 300 species, almost exclusively confined to Australia and replacing, in Australia, the large and more widely spread order *Ericaceae* of some 1,200 species. The *Epacridaceae* are shrubs rarely attaining tree-like dimensions, with regular complete. flowers either five—or more, rarely four—partite throughout. Sepals free. Petals usually white or red, united to form a corolla, usually enclosing the stamens. Ovary superior, of usually five united carpels, but one, two, up to ten-chambered with a central placenta and one to several seeds in each loculus. Fruit either a five-valved capsule with many seeds or fleshy with one or more stony, single-seeded kernels. Leaves either shortly stalked, sessile or sheathing. Flowers either solitary and axillary or in terminal racemes.

The order contains hardly any timber-yielding plants of economic value, but the flowers are of great importance to bee-keepers. *Epacris* flowers early in spring or late winter when bees have difficulty in finding honey. Many species of *Epacris* and *Styphelia* are highly decorative and are grown in gardens or greenhouses widely. A few have small edible berries (*Lissanthe sapida*, &c.).

LEUCOPOGON.

This genus was included by F. v. Mueller under *Styphelia*. It differs in having two bracts at the base of the calyx instead of four or more, a shorter corolla tube with the lobes bearded on the inner surface and the stamens almost sessile at the throat of the corolla, instead of distinct filaments often projecting beyond the throat. The seeds soon lose the power of germination.

Leucopogon lanceolatus, R.Br. "Lance Beard Heath." (Plate CCII.)

Description.—A tall shrub, sometimes almost a tree, 15 feet to 20 feet high, quite glabrous. Leaves 1 inch to 2 inches long, flat, mostly lanceolate and with longitudinal striae. Flowers in spikes, solitary in the upper axils or clustered at the ends of the branches. Bracts and bracteoles striate, about half as long as the calyx. Sepals about one line long, corolla tube about as long as the calyx, the lobes as long as the tube, beset inside with white hairs. Stamens five, rarely four. Ovary two-celled. Fruit ovate-globose, red, succulent.

Plate CCIII.—*Leucopogon* ~~*Richei.*~~ parviflorus THE COAST BEARD HEATH.

A. Flowering branch.
B and C. Flower from side and from above, showing bracteoles.
D. Gynaeceum.
E. Anther with filament and appendix.
F. Fruit with persistent calyx.

Plate CCIV.—*Monotoca elliptica.* The Tree Broomheath.

A. Fruit with persistent calyx.
B. Fruit with persistent calyx.
C. Flower from side.
D. Flower from above.

Habitat.—A native of South-West, North-East and East Victoria near the Snowy and Mitta Mitta Rivers, &c.; also in New South Wales, Queensland and Tasmania.

Timber.—Usually too small, but hard and tough and could be used for tool-handles.

Leucopogon Richei, R.Br. "Coast Beard Heath." (Plate CCIII.)

Description.—A tall shrub, sometimes almost a small tree, 15 feet to 20 feet high and up to 6 inches in diameter. Leaves $\frac{3}{4}$ inch to 1 inch long, elliptic lanceolate and broader above the middle, and with longitudinal striae. Spikes terminal in the upper axils, cylindrical, often rather long, but dense. Flowers small. Bracts and bracteoles striate and about as long as the calyx. Sepals scarcely one line long, obtuse. Corolla tube rather shorter than the calyx, beset inside with white hairs. Stamens five, rarely four. Ovary five or four-celled. Style short. Fruit ovoid-globose, whitish and succulent outside.

Habitat.—A native of South-West, South and East Victoria, usually on sandy or rocky sea coasts, but also extending inland and found in all the other Australian States except the extreme north.

Timber.—Usually too small, but hard and tough, and could be used for tool handles. When air-dry it averages 46 lb. per cubic foot.

Monotoca elliptica, R.Br. "Tree Broom Heath." (Plate CCIV.)

Monotoca is distinguished from *Leucopogon* by having two bracts to the flower and an unbearded corolla and from *Styphelia* by having instead of a five-chambered ovary, a one-chambered, one-seeded ovary forming a succulent drupe.

Description.—*M. elliptica* is a tall shrub or sometimes a tree up to 20 feet or even 30 feet high. Leaves $\frac{1}{2}$ inch to 1 inch long, ovate to linear elliptical, greyish beneath. Flowers very small, stalked, few or many together, sometimes functionally unisexual and on different plants. Sepals broad, very obtuse, half the length of the corolla. Corolla white, one to one and a quarter lines long, campanulate. Stamens five, rarely four. Ovary one-celled, tapering into a short style. Fruit ovoid, one and a half to nearly two lines long, with one seed, and red or orange outside.

Habitat.—A native of South West, North-East and East Victoria, at Sealer's Cove, Wilson's Promontory, Port Albert, and on the Baw Baw Mountains up to an elevation of 4,000 feet, &c.; also in New South Wales, Queensland and Tasmania, usually near the coast.

Timber.—Light, brown, hard, close-grained, and with a good small figure. Could be used for tool handles, wooden mallets and planes and cabinet work. A cubic foot weighs 45 lb. to 50 lb. when air dry.

Rapanea Howittiana

Plate CCV.—*Myrsine variabilis*. The Muttonwood.

A. Transverse section of drupe.
B. Drupe.
C. Longitudinal section of drupe.
D. Flower enlarged and expanded.
E. Branch to show variation in leaf shape.
F. Branch with fruit.
G. Branch with flowers.

MYRSINACEAE.

A small order of shrubs or trees, comprising 25 genera and about 600 species, with alternate, entire or toothed, often leathery leaves, mainly in tropical and sub-tropical regions. It includes one of the Mangroves (*Aegiceras*) and many species are grown in gardens (*Ardisia*, &c.) In *Aegiceras* and in *Ardisia crenata* the seeds germinate while the fruit is still attached. Many species are used medicinally (*Ardisia humilis*) in Ceylon against fever and the leaves usually possess resin-containing spaces.

Flowers four or five partite, usually hermaphrodite. Petals usually on a short or long corolla tube. Stamens five, opposite to the petals, occasionally with alternating staminodes. Ovary superior, rarely inferior, one-chambered, with a basal or free-central placenta and several ovules often sunk in the placenta. Fruit drupaceous, one to several seeded. The seeds rarely germinate well after the second or third year.

Rapanea Howittiana F.M.

Myrsine variabilis*, R.Br. "Muttonwood." (Plate CCV.)

Description.—A glabrous tree, sometimes reaching 40 feet to 50 feet. Leaves toothed, 1½ inches to 2½ inches long, narrowed into a petiole, elliptic to lanceolate obovoid. Flowers small, on stalks of about two lines. Calyx very small with short broad lobes. Corolla one and a half lines long, divided near the base into four or five acute lobes, greenish. Stamens five or four, nearly sessile at the base of the lobes. Fruit small, globular.

Habitat.—A native of South, North-East and East Victoria, near Melbourne and all over the forest creeks of Gippsland also in New South Wales and Queensland.

Timber.—Pale, with darker medullary rays, giving a good figure straight grained, fairly hard. Useful for furniture and cabinet work.

OLEACEAE.

A small order of shrubs or trees containing 21 genera and about 400 species mainly distributed in temperate and sub-tropical regions, but extending to the tropics particularly in the East Indies.

Flowers hermaphrodite, but in the Ash, male, female and hermaphrodite flowers occur in polygamous clusters. Calyx small, bell shaped, tubular or flat, usually with four teeth, rarely absent. Corolla the same. Stamens two (rarely three to five), alternating with the two chambers of the ovary. Usually two ovules in each chamber, rarely one or more than two. Fruit a berry, drupe or capsule, with one to four, rarely more seeds, usually one only. Leaves opposite, rarely whorled or scattered, entire or pinnate or palmate.

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* Myrsine being a Linnean name is retained in preference to "Rapanea."

Plate CCVI.—*Notelaea ligustrina.* The Privet Mock Olive.

A. A branch (about natural size).
B. A flowering raceme (enlarged).
C. A flower, one pair of petals removed (considerably enlarged).
D. A cluster of drupes.

Plate CCVII.—*Notelaea longifolia*. The Large Mock Olive.

A. A flowering branch (about natural size).
B. A drupe (slightly enlarged).
C. Transverse section of drupe—
(*a*) Seed.
(*b*) Endocarp.

N. venosa

Many species are decorative garden plants. Lilac (*Syringa*), Jasmine (*Jasminum*), Privet (*Ligustrum*), *Forsythia*, &c. The Ash (*Fraxinus*) includes 40 species, mainly of valuable timber trees in North America, the Mediterranean and Eastern Asia, while the Olive is valuable not only for its oil yielding fruits but also for its timber.

NOTELAEA.

The genus belongs to the section of the order with hanging seeds, entire, undivided, drupaceous or berry-like fruits, usually one-seeded. The petals are often united at the base into two pairs by the insertion of the stamens. It includes some six Australian species, one from Madeira and one from the Canaries. The seeds do not keep well, rarely germinating after the second or third year.

Notelaea ligustrina, Vent. "Privet Mock Olive." (Plate CCVI.)

Description.—A tall shrub or small tree 30 feet to 35 feet high. Leaves 2 inches to 4 inches long, narrow to linear lanceolate, the smaller veins faint. Flowers on rather long pedicels, in short sessile axillary racemes. Calyx lobes one third to half as long as the petals, which clasp the nearly sessile stamens. Style short with an entire or two lobed stigma. Fruit nearly globular, white to purple, nearly $\frac{1}{2}$ inch diameter when ripe.

Habitat.—A native of South, North-East and East Victoria, on the Upper Yarra and also in New South Wales and Tasmania, in forest valleys.

Timber.—Pale, hard, close-grained, useful for turnery, cabinet work, carriage building, brush backs and tops. A cubic foot weighs 55 lb. to 58 lb. when seasoned. It is known sometimes as silkwood, from its pale glossy sheen when polished.

Notelaea longifolia, Vent. "Large Mock Olive." (Plate CCVII.)

Description.—A tall shrub or slender tree up to 45 feet high. Leaves 2 inches to 6 inches long, from ovate to broadly lanceolate, the veins prominent. Pedicels about as long as the flowers in axillary racemes, rarely 1 inch long.

Calyx small, obscurely toothed, opening flat. Petals scarcely one line long, yellowish. Anthers large, almost sessile and clasped by the petals. Fruit ovoid or globular, $\frac{1}{2}$ inch diameter and of a dark bluish colour.

Habitat.—A native of East Victoria, in woods on the eastern part of Gippsland; also in New South Wales and Queensland.

Timber.—Pale, hard, close-grained, useful for turnery, cabinet work, carriage building, brush backs and tops. A cubic foot weighs 55 lb. to 60 lb. when air-dry. It is known sometimes as "Silkwood," from its pale glossy sheen when polished.

BOTANIC & DOMAIN GARDENS

Plate CCVIII.—*Ehretia acuminata* R.Br. The Brown Cedarwood.

A. Flowering twig (slightly reduced).
B. Flower (enlarged).
C. Part of corolla showing insertion of stamens upon the corolla tube.
D. Small portion of panicle bearing fruits.

BORAGINACEAE.

A large genus of herbs or shrubs, rarely trees, including 85 genera and 1,600 species mainly found in the Mediterranean and Californian regions. It is poorly represented in Australia which has only one purely endemic genus, *Halgania*, while *Ehretia* has its main centre in Indo-Malaysia and extends also to Australia. That the sparse occurrence of the order in Australia is not due to climatic conditions is shown by the fact that the Mediterranean *Echium plantagineum* has spread through the North of Victoria to such an extent as to become a troublesome and proclaimed weed known as "Patterson's Curse," from the name of the settler who is supposed to have introduced it. Leaves usually alternate and roughly hairy or bristly. Flowers usually regular and five, rarely four-partite. Sepals usually five, forming a bell-shaped or tubular calyx. Corolla usually tubular with a broad spreading five-lobed rim. Stamens equal to the petals and alternating with them. Ovary of two carpels, each subdivided into two one-seeded chambers, rarely into three to ten chambers. Fruit usually of four nutlets.

EHRETIA.

A genus of 40 shrubs or trees mostly tropical and containing several useful timber trees. Flowers white, calyx small, five-partite. Corolla with five blunt lobes. Stamens five, usually projecting beyond the tube of the corolla. Ovary of two carpels, each partially or completely divided into two. Fruit of four one-chambered cocci ; or two two-chambered cocci. Style bifid, with capitate or club-shaped stigma.

Ehretia acuminata, R.Br. "Brown Cedar-wood." (Plate CCVIII.)

Description.—A tall shrub or tree 20 feet to 30 feet high. Leaves 3 inches to 6 inches long, pointed, finely serrate, ovate to lanceolate elliptical. Flowers deciduous, almost sessile, small and crowded on the branchlets of dense thyrsoid panicles. Calyx segments about three-quarter lines long and nearly orbicular. Corolla whitish, the tube short, the lobes spreading to about three lines diameter. Stamens five, rarely four or six. Anthers exserted. Ovary four-celled with one ovule in each cell. Style lobes short. Fruit globular, two to three lines diameter, reddish outside.

Habitat.—It is occasionally planted in Victoria, but is only native in New South Wales and Queensland.

Timber.—Brown, slightly resembling cedar. Useful in cabinet work and could be used for furniture and turnery, but is usually too small.

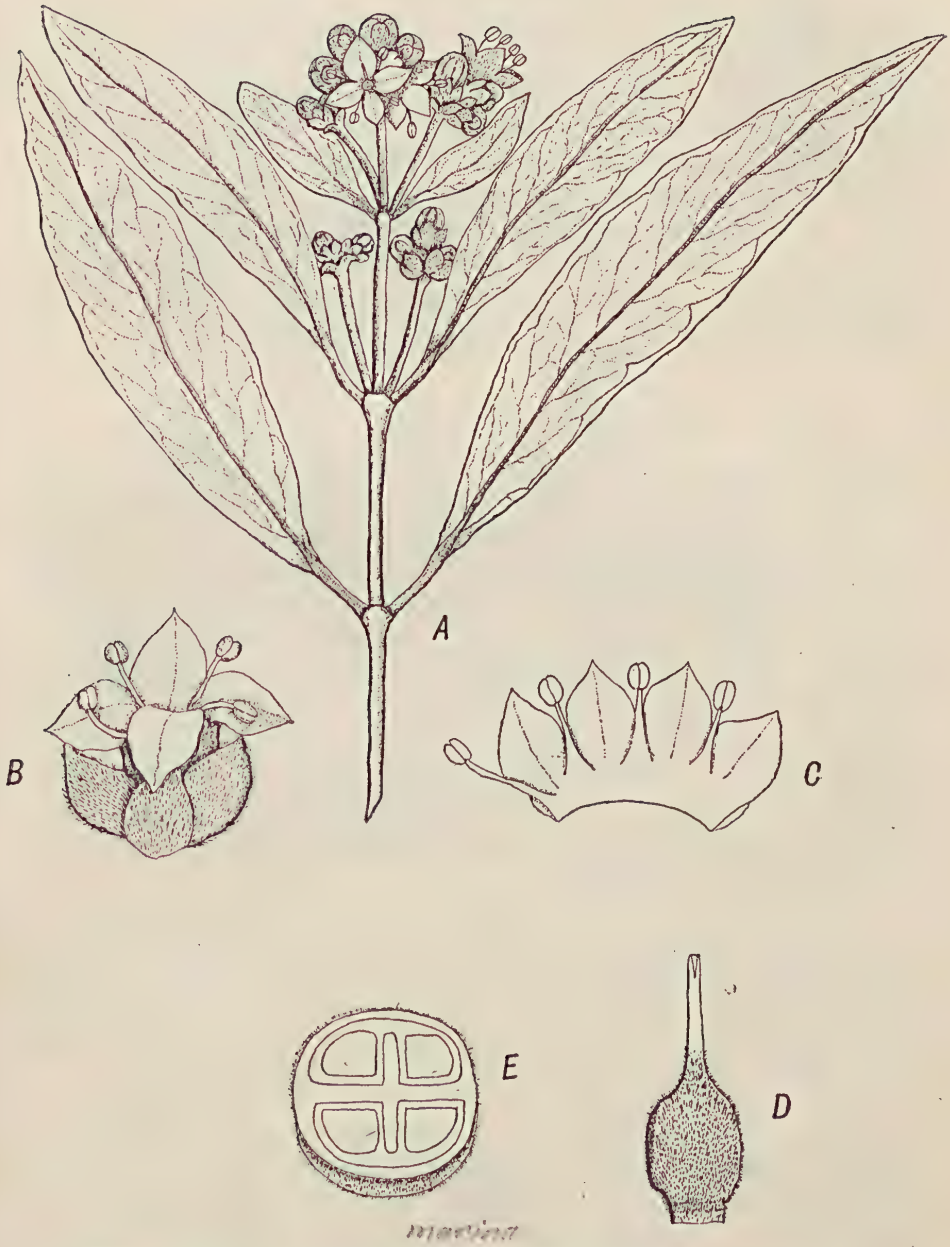

Plate CCIX.—*Avicennia officinalis*. The White Mangrove.

A. Flowering twig.
B. Flower (much enlarged).
C. Corolla opened out to show insertion of stamens.
D. Ovary.
E. Fruit cut transversely.

VERBENACEAE.

A mainly tropical or sub-tropical order of herbs, shrubs or trees containing about 800 species and 70 genera. Flowers usually irregular and hermaphrodite, rarely unisexual by abortion. Calyx bell-shaped or cup-shaped with usually four or five free lobes. Corolla usually with a cylindrical or funnel-shaped, often bent tube and four to five free lobes. Stamens four, usually unequal, rarely two or five. Ovary superior, sessile, four-lobed or four-partite, but usually developing additional, up to six, false partition walls. Chambers with two ovules, or if subdivided, with one. Fruit usually drupaceous, rarely a capsule, usually separating into drupels or cocci, rarely indehiscent.

Avicennia officinalis, L. "White Mangrove." (Plate CCIX.)

Description.—A shrub or small tree 6 feet to 40 feet high, but in Victoria, usually stunted. Leaves 2 inches to 3 inches long and 1 inch to 1½ inches broad, opposite, entire, leathery, smooth above, but with grey or brown hairs on the under side. Flowers in small heads on angular peduncles. Bracts shorter than the sepals and like them covered by short silky hairs. Sepals four or five, orbicular about one and a half lines long. Corolla tube, bell-shaped, shorter than the sepals, with four or five spreading lobes. Stamens four or five, scarcely projecting from the flower. Ovary very hairy, usually two-celled. Fruit opening by two thickened valves when submerged in water, one-seeded by abortion, the embryo developing lateral roots and a well developed plumule before the fruit opens. Dried plants usually turn black. The seeds are killed by drying and hence cannot be kept.

Habitat.—Extending on the sea-coast all round the Australian continent, mainly in mudflats covered by the tide at high water and useful in checking coastal erosion and the blocking of channels through marine mudflats. Although mainly tropical and sub-tropical, it extends far south, Wilson's Promontory being its southernmost locality.

Timber.—The wood is pale, hard, tough and lamellated and the stem shows an abnormal type of secondary thickening, successive rings of bundles and sclerenchyma alternating. In Victoria the timber is too small to be of economic value. The bark yields tannin. The wood was used by the aborigines for shields. The ash contains 4 per cent. and that from the leaves 6 per cent. of potash.

LABIATAE.

An order of about 150 genera and 3000 species, world wide in distribution, but most abundant in the Mediterranean and Asiatic regions. Usually aromatic herbs with quadrangular stems and opposite leaves but often shrubby and very rarely tree-like.

Plate CCX.—*Prostanthera nivea.* The Snowy Mint Bush.

A. Flower.
B. Gynaeceum.
C. } Stamens.
D. }
E. Calyx, with style and stigmas.

Plate CCXI.—*Prostanthera rotundifolia.* Round-leaf Mint Bush.

A. Part with flowers.
B. Flower (side view).
C. Corolla laid open.
D. Gynaeceum.
E. Back of stamen.

Flowers almost always zygomorphic and hermaphrodite. Calyx persistent, gamosepalous, usually five-partite, rarely four-partite, often two-lipped. Corolla tubular, with five or more lobes, two- or one-lipped, often with a hood at the back and a three-petaloid lip in front.

Stamens four, unequal, epipetalous, sometimes only two by abortion, very rarely five. Ovary superior, with a basal disc often forming a nectary, bi-carpellary, each carpel divided into two one-seeded pieces, separating as cocci in the ripe fruit.

Epidermal glands are commonly present and ethereal aromatic oils occur in the leaves (Thyme, Marjoram, Basil, Sage, Mint, Lavender, Rosemary). Many are favourite garden plants (Salvia, Leonotus, Prostanthera). The shrubby Prostanthera section of the *Labiatae* is entirely confined to Australia.

PROSTANTHERA.

The genus contains over 40 species, mainly in the southern half of Australia, often up to alpine regions. Flowers white or red, shortly stalked. Calyx bell-shaped, ten to fifteen nerved, rim two-lipped, the lips entire or the lower one slightly lobed. Corolla with a short bent tube widening at the throat, two-lipped, the upper lip short and broadly two-lobed, the lower short or rarely long, of three segments, the median one broad and entire or two-lobed. Stamens four of unequal lengths the anterior pair longer, but shorter than the upper lip. Anthers two-celled, with prominent appendage. Style bifid at the top. Nutlets obovate, surface reticulate, attached by a broad concave base. The seeds keep fairly well but rarely germinate after the third to fifth year.

Prostanthera nivea, "Snowy Mint Bush." (Plate CCX.)

Description.—A tall slender shrub 8 feet to 10 feet high, usually glabrous. Leaves ½ inch to 1 inch long, somewhat incurved at the margin, equally green on both sides entire and broadly linear. Flowers rather large, snow-white or tinged with pale blue. Pedicels much shorter than the calyx, which is 2½ lines to 3 lines long, the upper lobe longer than the lower. Corolla pubescent or villous, spotted at the throat with brown or greenish yellow. One of the appendages longer than the anthers.

Habitat.—A native of South-West, and South Victoria, on mountains near Bacchus Marsh, Mount Korong, Mount Hope, Station Peak, &c.; also in New South Wales and Queensland.

Timber.—Too small to be of economic value.

Prostanthera rotundifolia, R.Br. "Round-leaf Mint Bush." (Plate CCXI.)

Description.—A tall, very bushy shrub, 10 feet to 15 feet high. Leaves ¼ inch to ½ inch long, stalked, rather thick, slightly indented, more or less rounded. Flowers axillary in short, close, terminal, partly leafy, racemes. Corolla lilac. Appendages shorter than the anthers. Pedicels shorter than the calyx, which is about two lines long.

Plate CCXII.—*Prostanthera lasianthos.* The Christmas Bush.

A. Flowering branch.
B. Calyx.
C. Corolla opened out.
D. Stamen showing anther and two different sized spurs.
E. Gynaeceum.

Habitat.—A native of South-West, South, North-East and East Victoria on the Buffalo Ranges, at Bacchus Marsh, Mount Zero, Avon and Genoa Rivers, Mount Arapiles, &c. also in New South Wales, South Australia and Tasmania.

Timber.—Too small to be of economic value. Flowering from November to December.

Prostanthera lasianthos, Labill. "Christmas Bush." (Plate CCXII.)

Description.—A tall shrub, sometimes attaining the dimensions of a small tree, 20 feet to 30 feet high. Leaves 2 inches to 3 inches long, glabrous, usually thin and flat. Flowers opposite in pairs, in short leafless racemes, white tinged or spotted with pink or purple. Pedicels short, bracts linear. Calyx shortly pubescent three lines long in fruit. Corolla often ½ inch long. One of the appendages of the stamens longer than the anthers.

Habitat.—A native of South-West, South, North-East and East Victoria, on the banks of streams near Melbourne, on the Dandenong, Mount Disappointment and various parts of Gippsland; also in New South Wales, Queensland, South Australia and Tasmania.

Timber.—Rather soft and perishable, though tough. Of no economic value. Flowering from November to December.

MYOPORACEAE.

A small order of six genera and about 100 species, all Australian excepting one each in China, Japan, Mauritius, the Sandwich Islands, West Indies and West Africa and two in South Africa. The order forms a connecting link between the *Scrophulariaceae* and the *Verbenaceae*.

Flowers hermaphrodite, actino- or zygo-morphic and bilabiate. Calyx five-partite. Corolla of five petals. Stamens epipetalous, four in pairs of unequal length. The fifth stamen usually represented by a staminode. Ovary superior, with one to eight seeds in each loculus or three to ten chambered by secondary partitions arising early and forming one-seeded pieces. Fruit a one or more chambered drupe, sometimes splitting, into one-seeded stones. Trees or shrubs with opposite or alternate leaves, entire exstipulate. Flowers bractless. Stem and leaves often hairy, woolly or glandular.

EREMOPHILA.

This genus is distinguished from *Myoporum* by having a coloured bilabiate instead of a white regular corolla and from *Pholidia* by having pairs of super-imposed ovules in each cell instead of a single pair only. All the species are Australian. The flowers are usually solitary and stalked in the axils of the leaves. The fruit is either four-celled, with one seed in each, or splits into four one-seeded drupels, rarely fewer by abortion. The calyx is often enlarged after flowering. Over 40 species mainly in the southern half of Australia. The seeds rarely germinate after the second or third year.

Plate CCXIII.—*Eremophila longifolia.* The Berrigan.

1. Flower from side.
2. Corolla cut open, showing insertion of stamens.
3. Calyx and gynaeceum.
4. Fruit from side, the upper part of the pericarp removed.
5. Central stone of fruit.
6. Fruit in transverse section.

Plate CCXIV.—*Eremophila oppositifolia.* The Twin-leaf Emubush.

1. Flower from side.
2. Corolla cut open, showing insertion of stamens.
3. Older flower showing sepals and gynaeceum, the corolla fallen.
4. Fruit.
5. Fruit in transverse section.

Plate CCXV.—*Eremophila bignoniflora.* The Bignonia Emubush.

1. Flower from side.
2. Corolla cut open, showing insertion of stamens.
3. Fruit.
4. Older flower showing gynaeceum and sepals, the corolla fallen.
5. Transverse section of fruit.

Eremophila longifolia, F.v.M. "Berrigan." (Plate CCXIII.)

Description.—A tall, erect shrub or small tree, 10 feet to 20 feet high Leaves 2 inches to 5 inches long, on short petioles, narrow to linear-lanceolate. Flowers on short pedicels of two to five lines long, solitary or two together. Calyx very small. Corolla ¾ inch to 1 inch long, the lobes all ovate and obtuse, the lower lobe longer than broad. Stamens four, slightly projecting. Ovary thick and fleshy with two pairs of ovules in each cell. Fruit ovoid or globular, dark-coloured, fleshy with a single hard four-celled stone.

Habitat.—A native of North-West and South-West Victoria, in the Wimmera, on the Murray and Avoca Rivers, Lake Hindmarsh, &c.; also in all the other Australian States except Tasmania. In New South Wales, Queensland, and Western Australia it attains a larger size than in Victoria.

Timber.—Brown with a paler sap-wood, hard with a close waxy grain somewhat like that of satin-wood and durable. A cubic foot averages 55 lb. to 60 lb. when seasoned. It is rather hard to work, but useful for panelling, cabinet work, veneers and parquet flooring.

Eremophila oppositifolia, R.Br. "Twin-leaf Emubush." (Plate CCXIV.)

Description.—A tall shrub or small, elegant spreading tree, 15 feet to 30 feet high. Leaves 1 inch to 2 inches long, on short petioles, usually in pairs, lanceolate to linear with recurved points. Flowers axillary, solitary on pedicels of two to three lines. Calyx lobes six to eight lines long. Corolla nearly 1 inch long, lower lobe as broad as long. Stamens four, as long as the corolla. Ovary shortly villous with one pair of ovules in each cell. Fruit dry, small, narrow to ovate ellipsoid.

The two foregoing species show an approach to *Pholidia*.

Habitat.—A native of North-West Victoria, at the junction of Murray and Murrumbidgee Rivers, &c.; also in New South Wales, South and Western Australia, usually in dry districts.

Timber.—Brown with a paler sap-wood, hard with a close waxy grain, somewhat like that of "Satinwood," durable. A cubic foot averages 55 lb. to 60 lb. Rather hard to work, but useful for panelling cabinet work, veneers and parquet flooring. Usually rather small.

Eremophila bignoniflora, F.v.M. "Bignonia Emubush." (Plate CCXII.)

Description.—A strong-scented tall shrub or small tree 20 feet to 30 feet high, often with sticky branches. Leaves 2 inches to 6 inches long, lanceolate acuminate. Flowers solitary on pedicels ¼ inch to ½ inch long. Calyx lobes two to three lines long. Corolla about 1 inch long,

Plate CCXVI.—*Eremophila alternifolia.* The Tufted Emu

1. Flower from side.
2. Corolla cut open, showing insertion of stamens.
3. Sepals and gynaeceum of older flower, the corolla fallen.
4. Fruit from side.
5. Fruit in transverse section.

Plate CCXVII.—*Myoporum platycarpum.* The Sugar Wood.

1. Fruit in transverse section.
2. Anther with portion of filament.
3. Flower from side.
4. Fruit in longitudinal section, showing two seeds.

the lower lobe broader than long and slightly cleft. Stamens slightly projecting, but shorter than the short broad corolla lobes. Ovary two-celled with two pairs of ovules in each cell. Fruit dry but drupaceous, ovate, acute, ½ inch long, with a more or less four-celled hard stone.

Habitat.—A native of North-West Victoria, along the lower Murray, &c.; also in New South Wales, Queensland and South Australia, usually in dry inland districts.

Timber.—Brown with a pale sap-wood, hard, with a close waxy grain, somewhat like that of "Satinwood," durable; a cubic foot averages 55 lb. to 60 lb. when seasoned. It is rather hard to work, but useful for panelling, cabinet work, veneers and parquet flooring. Usually rather small.

Eremophila alternifolia, R.Br. "Tufted Emubush." (Plate CCXVI.)

Description.—A tall erect, much branched shrub, 10 feet to 15 feet high. Leaves rarely above 1 inch long, usually with a recurved point and linear or terete. Flowers large, axillary, solitary on curved stalks. Calyx lobes three to four lines long, the outer ovate, the inner orbicular. Corolla red, spotted with purple, ¾ inch to 1 inch long, the lower lobe longer and narrower than the upper four. Stamens within the corolla. Ovary glabrous with only one pair of ovules in each cell. Fruit ovoid, dry, separating into four thin-walled one-seeded drupels.

Habitat.—A native of North and South Victoria, in the Mallee; also in New South Wales, South and Western Australia, usually a desert species.

Timber.—Too small to be of economic value.

MYOPORUM.

A genus of about 25 shrubs and trees, mainly Australian. Flowers usually white and small, singly or in clusters in the axils of the leaves. Calyx five-partite, not enlarged after flowering. Corolla with a short tube, and five nearly equal lobes. Stamens four, in pairs of unequal length, rarely five, hardly or shortly projecting from the flower. Ovary two to ten chambered, ovules one to two in each chamber. Drupe nearly globular and with two to ten one-seeded chambers. The seeds rarely germinate after the second or third year.

Myoporum platycarpum, R.Br. "Sugar Wood." (Plate CCXVII.)

Description.—A tall shrub or small tree, 15 feet to 20 feet high, quite glabrous. Leaves rather thick, linear-lanceolate, 1½ inches to 3 inches long. Flowers in axillary clusters of six or more on pedicels one to two lines long. Calyx under one line long, the lobes acute. Corolla two or more lines long, bearded inside. Ovary two-celled with one ovule in each cell. Fruit ovate or ovate-oblong, narrow edged, pointed, about three lines long.

Plate CCXVIII.—*Myoporum insulare.* The Coast Boobialla.

1. Flower from side.
2. Anther and portion of filament.
3. Fruit in transverse section.
4. Fruit in longitudinal section.

Plate CCXIX.—*Myoporum Dampieri.* The Water Bush.

1. Flower from side.
2. Anther and portion of filament.
3. Fruit from side, showing persistent calyx.
4. Fruit in transverse section, showing four one-seeded cells.

Habitat.—A native of North-West Victoria, in the Wimmera; also in New South Wales, South and Western Australia.

Often yielding Manna and also a resin similar to shellac.

Timber.—Usually too small to be of economic value.

Myoporum insulare, R.Br., "Coast Boobialla." (Plate CCXVIII.)

Description.—A tall shrub often dwarfed and diffuse on the sea coast but sometimes a tree 20 feet to 30 feet high and 6 inches to 8 inches in diameter. Leaves 1 inch to 3 inches long, but very variable. Flowers small, two or more in each axil. Calyx lobes short and lanceolate to subulate. Corolla lobes usually as long as the tube and slightly bearded inside. Stamens four. Ovary with three, or two or four one-seeded cells. Fruit globular or ovoid, one to three lines diameter, fleshy outside and purplish blue.

Habitat.—A native of South-West, South and East Victoria, along the whole coast of Gippsland and westward to the Glenelg; also in all the other Australian States with the exception of Queensland.

The plant stands exposure well and is an important factor in checking coastal erosion by wind and water.

Timber.—Usually too small to be of economic value, except for cabinet work and turnery.

Myoporum Dampieri, Cunn. "Water Bush." (Plate CCXIX.)

Description.—A small tree, very variable and occasionally 30 feet high. Leaves 1½ inches to 3 inches long. Flowers in axillary clusters of two to four on pedicels two to four lines long. Calyx tube rarely over one line long. Corolla campanulate and three to four lines long. Anthers just projecting from the corolla. Ovary of four one-seeded cells, rarely three. Drupe nearly globular, two to three or more lines diameter, fleshy outside.

Habitat.—A native of North-West Victoria, in districts along the lower Murray and in all the other Australian States except Tasmania.

Timber.—Usually too small to be of economic value, except for cabinet work and turnery.

RUBIACEAE.

A large order of about 350 genera and 500 species, mainly tropical but also represented in temperate regions, while a few species of *Galium* extend to the arctic regions and to alpine summits in the tropics. Many have been spread widely from their original homes by cultivation (Coffee, Cinchona, Gardenia) or as weeds (Galium, Sherardia, Spermacoce).

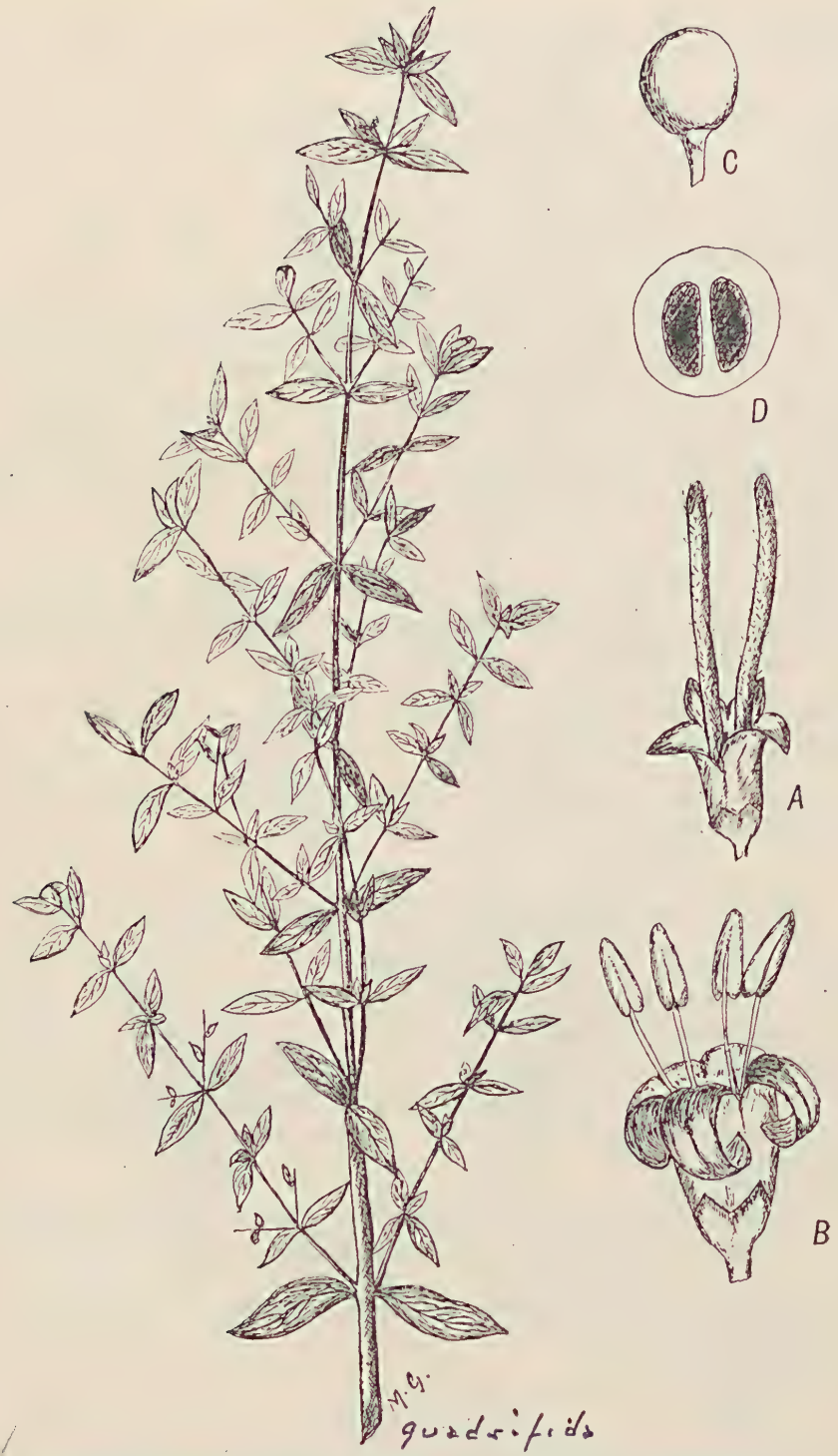

Plate CCXX.—*Coprosma Billardieri.* Prickly Coprosma.

A. Carpellary flower.
B. Staminate flower.
C. Fruit.
D. Section of fruit.

Flowers usually hermaphrodite. Calyx, corolla and androeceum, usually all in fours or fives. Corolla, plate, bell or wheel-shaped or tubular with free lobes. Stamens rarely fewer than the petals, anther two-chambered with longitudinal dehiscence. Pollen grains small. Two lobed or tubular disc usually present. Ovary inferior of one to several, but usually two chambers. One to several seeds in each chamber. Fruit a berry, drupe or capsule, or a shizocarp splitting into cocci.

Herbs, shrubs or trees with opposite, entire leaves, rarely alternate and toothed or lobed. Stipules present. Raphides very common in the tissues. The order includes many decorative shrubs and economic plants such as Cinchona (Quinine), Ipecacuanha, Gambier, Coffea (Coffee). *Rubia tinctorium* (Alizarin dye) as well as herbs used in popular medicine, *Galium verum*, "Bedstraw," Borreria (false Ipecacuanha), or for snake bite (Pentus). Many are myrmecophilous and provide shelter and food for protective ants, which keep off leaf-cutting ants and other enemies (*Hydnophytum, Myrmecodia, Cuviera*).

The wood of many tropical species is hard and valuable (*Burchellia bubalina*, "Buffalo Wood." *Erithalis*, "Lemon-wood" and *Ixora*).

COPROSMA.

A genus of over 40 species of small shrubs or trees with opposite, rarely whorled, leaves, and small white or green flowers in axillary or terminal small cymes or rarely heads.

Flowers usually unisexual, calyx cylindrical with a toothed or lobed rim. Corolla with four to nine lobes, the four to nine stamens epipetalous at its base and projecting from the throat, ovary two, rarely four chambered, styles free, hairy. Drupe oval to spherical. The seeds do not keep well, rarely germinating after the second or third year.

The genus is most abundant in New Zealand but extends to Norfolk and Sandwich Islands as well as to Australia, Malaysia and Chili. In Java *C. sundanum* grows on alpine summits 9,000 feet to 11,000 feet high.

Coprosma Billardieri, Hk.f. "Prickly Coprosma." (Plate CCXX.)

Description.—A slender twiggy shrub, 10 feet to 15 feet high, the smaller branches often spiny. Leaves under $\frac{1}{2}$ inch long, thin, glabrous, narrow to ovate lanceolate. Flowers very small, solitary, at the ends of very short axillary shoots with a pair of bracteoles under the calyx. Calyx tube very short, with four small acute lobes or teeth. Stamens four or five, rarely more or less. Corolla about two lines long and styles four to five lines long. Fruit small, red.

Habitat.—A native of South, North-East and East Victoria, along the Yarra, on the Dandenong Ranges, at Corner Inlet, &c.; also in New South Wales and Tasmania.

Timber.—Too small to be of economic value. When air-dry it averages 46 lb. per cubic foot. *Coprosma hirtella*, the rough coprosma, is a smaller shrub which has the flowers usually in small clusters instead of solitary and a slightly rough surface and rather large leaves. The New Zealand *C. Baueri* is often grown as a garden shrub with rather large glossy green or variegated leaves and drooping branches. The name coprosma indicates a fetid aroma which is, however, not specially marked and is certainly a libel on the Australian species.

CAPRIFOLIACEAE.

A small order of trees and shrubs or climbers with opposite leaves mainly confined to temperate regions, containing ten genera and nearly 300 species, mainly of Viburnum and Lonicera.

Flowers hermaphrodite, regular or zygomorphic. Calyx and corolla usually five partite. Stamens five, in Linnaea four, rarely fewer, epipetalous. Ovary of two to five carpels, styles either short and one to each carpel (Sambucus) or united long and capitate (Lonicera). Ovules usually single, hanging from the roof of each chamber. Fruit a berry, or a drupe with one or more stones (rarely capsular).

Many species of Viburnum, Sambucus (Elderberry) and Lonicera (Honeysuckle) are decorative garden shrubs or climbers. Some species of Viburnum and Lonicera yield useful wood, while the fruits of *Sambucus nigra* are edible and the flowers are used medicinally. The pith of the Elder is used for making Japanese water flowers, also as a support in section cutting and for pith balls.

SAMBUCUS.

A genus of about 20 trees or shrubs mainly in north temperate regions, but extending to Australia, though absent from New Zealand. Calyx short, three to five teeth or lobes. Corolla more or less wheel-shaped. Leaves pinnate. Stamens five, rarely less, ovary three to five chambered. Fruit a drupe with three to five one-seeded stones.

The wood of the larger species can be used, but it is soft, not very strong and usually has a rather pronounced central core of soft pith. The seeds of *S. racemosa* have been stated to germinate after being buried for about 100 years in the soil. Actual tests showed that there were no germinable seeds in ten and twelve years old samples. The seeds of *S. australasica* usually fail to germinate after keeping two or three years.

Plate CCXXI.—*Sambucus australasica.* The Yellow Elderberry.

1. Flower bud, side view.
2. Top view of an expanded flower.
3. Longitudinal section of a fruit.
4. Transverse section of a fruit.

Sambucus australasica (Lindl) Fritsch. (*S. xanthocarpa*, F.v.M.) "Yellow Elderberry." (Plate CCXXI.)

Description.—A tall shrub or small tree, 15 feet to 20 feet high. Leaflets three to five, stalked, 2 inches to 3 inches long. Flowers yellow, calyx and corolla usually tripartite, sometimes four-partite. Stamens three, four or five. Fruit a succulent yellow drupe with three to five one-seeded stones.

Habitat.—A native of East Victoria, in Gippsland ; also in New South Wales and Queensland. The only other native species, *S. Gaudichaudianus* is little more than a herb and has a whitish fruit.

Timber.—Too small to be of economic value. Might be useful for paper pulp, but not abundant.

COMPOSITAE.

The largest order of flowering plants, containing about 900 genera and 12,000 species and forming about one tenth of the whole of the flowering plants. The order is a young one and hence has developed as yet very few trees, while some genera such as Chrysanthemum and Dahlia are in a highly plastic condition, sporting freely and spontaneously outside the ordinary laws of heredity. Others such as Hieracium are imperfectly segregated into species, so that this genus in particular may according to taste be regarded as containing 60, 600 or 6,000 species.

Flowers small (florets) in heads usually surrounded by bracts, sometimes with bracts between the florets. All the florets hermaphrodite, or with outer female ray florets and hermaphrodite or male disc florets or with outer neuter florets. Calyx absent or represented by a pappus of hairs, scales or bristles or a membranous ring, usually persisting on the fruit (achene). Corolla tubular with five free lobes, rarely four or three, in hermaphrodite or male disc flowers, or tongue shaped with a very short tube in ray florets and in the hermaphrodite florets of *Liguliflorae* (Dandelion). Stamens, epipetalous, hardly projecting from the corolla tube, alternating with the petals, the filaments usually free, but the anthers cohering to form a tube around the style. Connective usually prolonged into an appendix. Anthers opening longitudinally sometimes with a pointed tail at the base. Ovary inferior, one-chambered, with a basal anatropal ovule, forming an achene usually crowned by a pappus. Style single usually with two stigmatic arms.

Oil is obtained from the seeds of the Sunflower, of *Guizotia abyssinica* and of *Madia sativa*. Insect powder from species of Chrysanthemum (*C. parthenium, roseum* and *coccineum*), a dye from *Carthamus tinctorius* (Saffron-flower), vermifuge from Vernonia and Artemisia (Wormwood) and Arnica from Arnica. Chicory, endive, the true Artichoke (*Cynara scolymus*) and the Jerusalem Artichoke (*Helianthus tuberosus*) belong, to the order, which also includes such decorative plants as Daisy, Aster Dahlia, Coreopsis, Zinnia, Sunflower, Chrysanthemum and Helichrysum (Everlasting.)

Plate CCXXII.—*Olearia argophylla.* The Musk Daisy Bush.

A. Branch with leaves and flower-heads.
B. Single flower-head.
C. Ray floret enlarged, showing ovary, pappus, corolla, style, and bifid stigma.
D. Disc floret enlarged, showing tubular corolla, with five free lobes, ovary, pappus, and bifid stigma.

Plate CCXXIII.—*Olearia lyrata.* The Snow Daisy Bush.

A. Branch with leaves and flower-heads.
B. Single flower head.
C. Disc floret, enlarged.
D. Ray floret, enlarged.
E. Fruit from side.

OLEARIA.

A genus of about 90 trees or shrubs, rarely herbs, confined to Australia and New Zealand, usually strongly scented.

Heads rather small, anthers pointed or tailed at the base. Fruit (achene) more or less cylindrical, not flattened, usually five or more ribbed. Pappus usually of several rows of fine bristles, the outer row usually short. The genus was included by Mueller under *Aster*, but this genus has flattened achenes usually without any ridges or veins and is almost always herbaceous and unscented. The achenes rapidly lose the power of germination after the first year, rarely being germinable after the second or third year.

Olearia argophylla, F.v.M. "Musk Daisy Bush." (Plate CCXXII.)

Description.—A tree attaining a height of 20 feet to 30 feet and about 1 foot in diameter usually growing among other trees and with a strong musky smell. Leaves 3 inches to 5 inches long, ovate lanceolate and usually denticulate, silky beneath.

Heads small, numerous in large terminal corymbs. Ray-florets about three to five, white and rather short, disc florets six to eight. Anthers small. Style arms short. Achenes slightly hairy. Pappus abundant.

Habitat.—A native of South, North-East and East Victoria, along the Genoa River, at Corner Inlet, on the Dandenongs at Bullarook; also in New South Wales and Tasmania.

Timber.—Pale yellow or light brown, tough, moderately hard, with a fragrance of musk. A cubic foot weighs 42 lb. when air-dry. Usually small but useful for cabinet work and small purposes. Burrs at the butt often give beautifully figured veneers.

Olearia lyrata, Hutch. (*O. stellulata partim*, D.C.) "Snow Daisy Bush." (Plate CCXXIII).

Description.—A shrub or small tree 10 feet to 20 feet, but in rich valleys or river banks attaining up to 30 feet. Leaves elongate lanceolate, acuminate, 8 inches to 15 inches long, 1½ inches to 3 inches broad, but often smaller, entire or with slightly indented or crenately undulate margins, usually wrinkled or reticulate above and with stellate hairs beneath. Heads in dense leafless racemose clusters, over-topped by the subtending leaves. Ray florets about eight to twelve, white, disc florets more numerous. Anthers scarcely auriculate. Style arms nearly pointed. Achenes usually hairy. Pappus with smaller bundles of hairs on the outside.

Plate CCXXIV.—*Olearia glandulosa.* THE SWAMP DAISY BUSH.

A. Flowering twig.
B. Tip of leaf magnified, showing glands.
C. Disc floret (enlarged).
D. Ray floret (enlarged).
E. Disc floret opened (enlarged).

Habitat.—A native of South, North-East and East Victoria, near Melbourne, on the Australian Alps and on Wilson's Promontory (Mount Vereker, &c.), Buffalo and Dandenong Ranges, Skipton and Gabo Island ; also in New South Wales, Queensland and Tasmania.

Timber.—Pale yellow or pale brown, tough, light, moderately hard, rather brittle, seasons well, with a fragrance of musk. Usually small, but useful for cabinet work, veneers and small purposes. The root stock shows bird's eye markings.

Olearia glandulosa, Benth. "Swamp Daisy Bush." (Plate CCXXIV.)

Description.—A rather tall, slender swamp shrub, 10 feet to 15 feet high. Leaves ½ inch to 1½ inches long, acute and revolute at the margin. Flower heads small, in terminal corymbs. Ray-florets about six to ten and white. Disc florets scarcely longer than the involucre. Anthers projecting beyond the corolla. Style arms short. Achenes glabrous or sparsely hairy. Pappus hairs silky and unequal in length.

Habitat.—A native of South-West, South, North-East and East Victoria, in marshy places on the Dandenongs, near the Delatite Rivers and near Creswick ; also in New South Wales, South Australia and Tasmania.

Timber.—Too small to be of economic value.

HELICHRYSUM.

A genus of over 300 species of herbs or shrubs, of which over 60 are Australian, spread over the whole world with the exception of America where it is unrepresented. Often cultivated as garden everlastings or immortelles.

Heads various, usually with many florets. Female florets fewer than the hermaphrodite or neuter florets. Bracts membranous, or with coloured spreading appendages. Achene, small, cylindrical, five-angled or slightly flattened. Pappus hairs numerous, usually in one series.

Helichrysum ferrugineum, Less. "Tree Everlasting." (Plate CCXXV.)

Description.—A shrub up to 15 feet or 20 feet high, with a close white or rusty coloured tomentum particularly on the under sides of the leaves. Leaves ½ inch to nearly 3 inches long, thin, flat or slightly recurved. Flower heads very numerous and small in a broad dense terminal compound corymb. Outer bracts pale yellow or brown and shining. Florets usually ten, occasionally only three or four in the head. Achenes minutely hairy. The seeds do not appear to remain germinable beyond five years, whereas seeds of *Helipterum incanum* and of *H. roseum* have been found to show 5 per cent. germination when ten years old.

Plate CCXXV.—*Helichrysum ferrugineum.* The Tree Everlasting.

A. Branch with leaves and flower-heads.
B. One of the petaloid bracts.
C. Floret enlarged.
D. Flower-head from side, showing basal bracts and petaloid spreading bracts.

Plate CCXXVI.—*Cassinia aculeata.* The Common Cassinia.

A. Portion of an inflorescence.
B. An expanded capitulum or flower-head (enlarged).
C. A flower (floret) much enlarged.

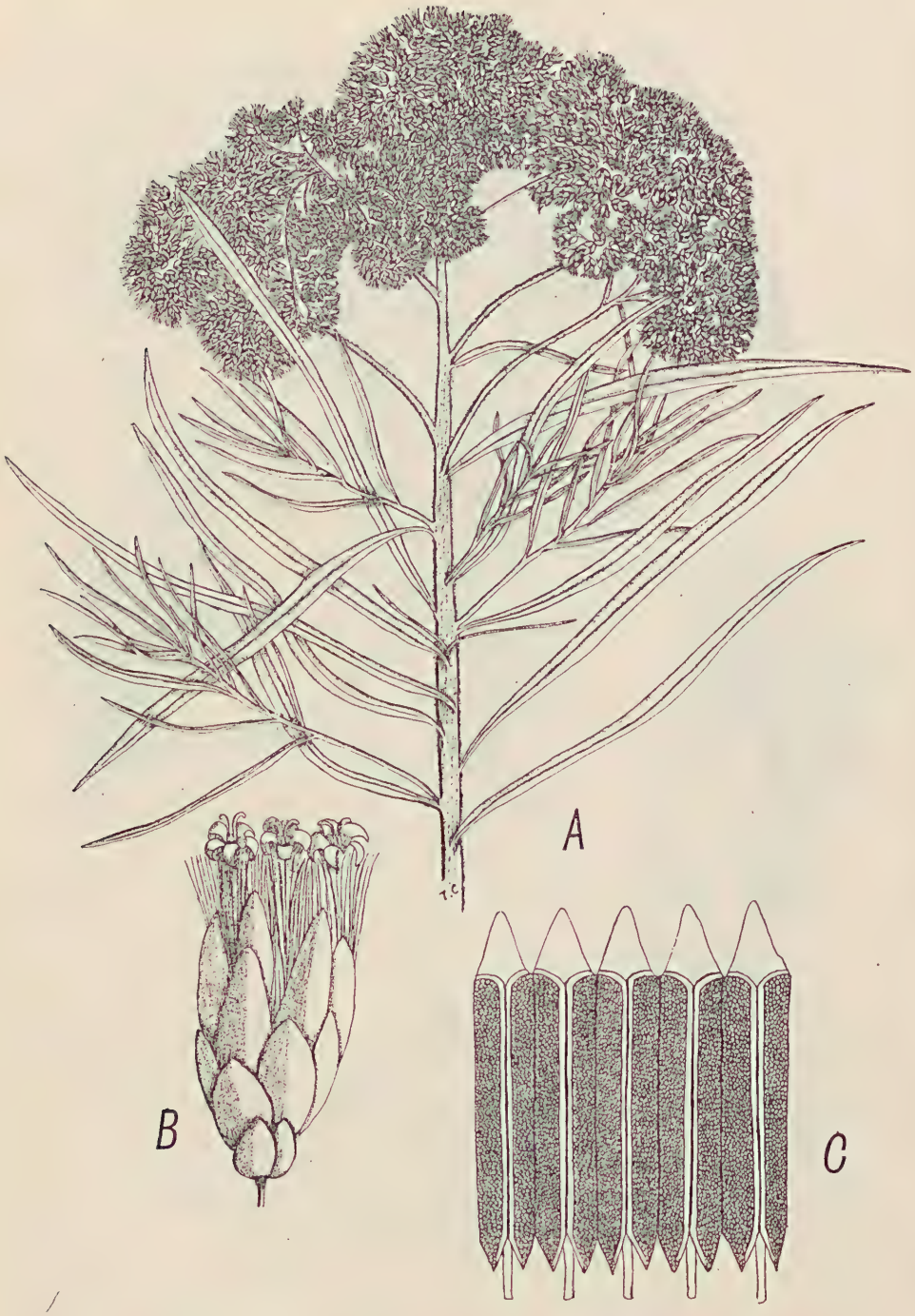

Plate CCXXVII.—*Cassinia longifolia.* The Shining Cassinia.

A. Portion of branch with inflorescence.

B. An expanded capitulum showing bracts and 3 florets.

C. Column of stamens detached from inside the corolla of a floret to show syngenesious anthers.

Habitat.—A native of South-West, South, North-East and East Victoria, around Port Phillip, along the Yarra and Snowy Rivers, at Creswick, &c.; also in New South Wales, South Australia and Tasmania.

Timber.—Too small to be of economic value.

CASSINIA.

A genus of about 20 shrubs, spread over the southern half of Australia, and also found in New Zealand and South Africa.

Heads small, the florets all similar or with a few female ones. Bracts membranous, more or less coloured, the inner ones sometimes with small appendages. Pappus of a single series of fine bristles, free or united just at the base. The seeds rarely show good germination after the first or second year.

Cassinia aculeata, R.Br. "Common Cassinia." (Plate CCXXVI.)

Description.—A rather tall shrub, 10 feet to 20 feet high, the branches and leaves shortly hairy. Leaves narrow, the edges revolute, ½ inch to 1½ inches long, scabrous on the upper surface. Heads very numerous, in broad terminal corymbs, somewhat like cauliflower heads and hence sometimes known as "Cauliflower Bush." Involucres narrow ovoid, the bracts obtuse, white or pale brown. Florets six to twelve. Receptacle scales as long as the florets.

Habitat.—A native of North-West, South-West, South, North-East and East Victoria, on the Dandenong and Healesville Ranges, at Portland, in Gippsland, &c.; also in New South Wales, South Australia and Tasmania.

Timber.—Too small to be of economic value.

Cassinia longifolia, R.Br. "Shining Cassinia." (Plate CCXXVII.)

Description.—A tall shrub, 10 feet to 15 feet high, the branches and leaves hoary or almost glabrous. Leaves smooth on the upper surface, 1 inch to 2 inches long, broader and with less recurved margins than in *C. aculeata*. Flower heads numerous in a broad dense cauliflower-like flat or convex corymb much exceeding the last leaves. Involucres oblong, about two lines long. Bracts very obtuse, opaque white, rarely pale brown. Florets six to eight in the heads.

Habitat.—A native of South-West, South, North-East and East Victoria, at Portland, Bacchus Marsh, along the Ovens River, &c.; also in New South Wales, Queensland and Tasmania.

Timber.—Too small to be of economic value.

Plate CCXXVIII.—*Bedfordia salicina.* The Blanket Leaf.

A. Branch with leaves and flower-heads.
B. Single involucral bract from flower-head, showing scarious margins.
C. Single floret enlarged.

BEDFORDIA.

A genus of two species of shrubs or small trees, one (*Bedfordia linearis*) found only in Tasmania.

Heads rather small, discoid, either solitary and axillary or in axillary clusters, florets all of one kind. Bracts nearly equal in a single row Pappus of numerous denticulate bristles, easily falling off. Plants stellate tomentose. Leaves alternate.

Bedfordia salicina, D.C. "Blanket Leaf." (Plate CCXXVIII.)

Description.—A tall shrub or small tree, 20 feet to 30 feet high, when young covered by white or grey stellate hairs. Leaves lanceolate, 3 inches to 5 inches long, narrowed to a petiole, soon glabrous on the upper surface. Heads in dense axillary panicles shorter than the leaves. About eight involucral bracts in a single row around the rather small heads, two to two and a half lines long. Achenes glabrous with four or five prominent ribs, the bristles of the pappus in a single row and very deciduous. Florets yellow. The seeds do not appear to germinate well after the first year.

Habitat.—A native of South, North-East and East Victoria, at Corner Inlet and Sealers Cove on Wilson's Promontory, Bullarook Forest, the Dandenong and Healesville Ranges, &c.; also in New South Wales and Tasmania.

Timber.—Pale, moderately tough and hard, can be used for cabinet work and small purposes. Sometimes known as dog-wood.

This species was placed by Mueller under the genus *Senecio* as *S. Bedfordi*. Senecio, has, however, the heads or inflorescences terminal whereas in *Bedfordia* they are axillary and the head is surrounded by a few bracts in one row instead of many in one or more rows, as is usually the case in *Senecio*.

THE CHIEF EXOTIC SOFTWOODS.

This heading is nearly synonymous with the group of the *Coniferae* as distinct from the *Dicotyledonous* "hard-woods" or broad leaf trees, and practically all the softwoods likely in the near future to be planted in Victoria as timber trees belong to this group. Hence a short account is given in the following pages of the commoner species, with keys for their identification and figures of some of the more important species. The group of *Coniferae* also includes, however, some trees with a very hard wood (Yews, Long-leaf Pine), while bass wood, poplar, aspen, cotton wood and Moreton Bay fig, while classed as "hard-woods" all have quite soft timber. Although the *Coniferae* form a characteristic feature of the woodland formations of most cool temperate districts, the group is also represented in sub-tropical regions, whereas in the tropics its place is taken for the most part by the allied group of the Cycads. The wood of *Coniferae* is characterized by the absence of vessels (or large pores), these and the small thick walled wood-fibres of dicotyledonous wood being represented by tracheides which are larger and longer than ordinary wood fibres, and have usually thinner walls and wider cavities. The tracheides, like wood fibres, are however developed from single cells and enclose a cavity with tapering ends, which is more or less filled with water when the wood is functioning for the ascent of sap. One peculiarity of the wood of most Conifers is that the older wood usually seasons and dries out to a large extent in the standing tree, so that freshly sawn timber from the centre of an old tree may not contain more than 30 per cent. or 40 per cent. of moisture. In dicotyledonous trees this condition is only attained by those trees which develop a well-marked central duramen. The central wood in some Conifers may become darker in colour (Red Pine, Sequioa, &c.), whereas in others the wood may be equally hard (or equally soft) and light in colour from the centre to the circumference (White Pine and Yew).

The medullary rays in Conifer Wood are usually one cell thick, and small and narrow. In the pine they have, in addition to parenchyma cells, transverse tracheidal cells with small bordered pits in rows transverse to the tracheides. The large bordered pits are, however, a special feature of the ordinary tracheides and are usually arranged in a single longitudinal row on each tracheide, but may be in two rows in *Ginkgo* or in several rows in *Agathis* and *Araucaria*. Owing to the regular rings and small evenly spaced medullary rays, the wood of a Conifer is very uniform in character, the grain being straight and rarely showing a very pronounced figure apart from that due to the annual rings. The rings

are mainly due to the autumn wood being denser and darker than the spring wood, and this again is due to the last formed tracheides in each year having smaller cavities and thicker walls. Practically all Conifers show well marked annual rings and these usually form a very reliable indication of the age of the tree.

CONIFERAE.

The *Coniferae* include two main groups, the *Taxoideae* with imperfectly developed cones with the seeds exposed and the *Pinoideae* (p. 222) in which the cones are well developed and enclose the seeds, which are inserted on the scales forming the cone. The scales project beyond the seeds, but do not enclose them. In the following pages keys are given to the sub-groups and genera, and a key to the species is given with each genus that contains more than three or four species. Only the commoner species are quoted, including all which have any timber value.

BOTANIC & DOMAIN GARDENS

TAXOIDEAE.

A. Seeds, one at the end of each carpel and bent round so that the micropyle is basal (*anatropal*), (*Podocarpus*), or twisted to one side. (*Dacrydium*). Carpels terminal or lateral. Pollen grains with air bladders, aril forming an additional outer integument to seed.. 1

B. Seeds one, rarely two, at the end of each carpel and straight (*orthotropal*). Aril as above, or formed by a fleshy enlargement of the single seed-coat. Pollen grains without air bladders 2

(1) Seeds inverted .. .. *Podocarpus.*

Seeds twisted to one side .. .. *Dacrydium.*

(2) Leaves with a broad lamina and a long stalk .. .. *Ginkgo.*

Leaves represented by flattened leaf-like shortly stalked shoots, arising in the axils of the true leaves which are reduced to scales *Phyllocladus.*

Leaves long, narrow and sessile, or only slightly tapering at the base 3

(3) Carpels present, two seeds to each, the carpels reduced in the ripe condition. Seed resembling a plum .. .. *Cephalotaxus.*

Carpels absent, the female flower reduced to a naked ovule .. 4

(4) Two seeds at the end of each fertile branch. Stamens with two pollen sacs .. .. *Torreya.*

One seed to each fertile branch. Stamens with six to eight pollen sacs .. .. *Taxus.*

PODOCARPUS.

A genus of some 40 species mainly in the temperate regions of the southern hemisphere, but also in South Asia (Japan, &c.). The leaves often resemble those of the Yew, but may also be shorter, more pointed and scale-like, i.e., of the Cypress type. The species are mainly tall trees and the timber has usually about the hardness of beech, i.e., it is a hard soft wood, but not very durable in the ground. The species are difficult to separate and about six are of importance for their timber.

Leaves 3 inches to 8 inches long 1
Leaves less than 3 inches to 8 inches long 2

1. Leaves lanceolate acuminate .. .. *P. neriifolia.*
   Leaves linear lanceolate, not acuminate, but acute, obtuse or falcate .. .. *P. macrophylla.*
2. Heart-wood brown to red 3
   Heart-wood white to yellow 5
3. Heart and sap-wood brown to brownish-white .. *P. ferruginea.*
   Heart-wood more or less reddish in colour 4
4. Leaves two rowed and ¼ inch to ½ inch long .. *P. spicata.*
   Leaves spirally arranged and ½ inch to 1½ inches long *P. Totara.*
5. Branches drooping, leaves small or scale-like *P. dacrydioides.*
   Branches spreading, leaves about 2 inches long 6
6. Timber yellow, fairly hard .. .. *P. Thunbergii.*
   Timber brownish-white, rather soft .. .. *P. elongata.*

P. dacrydioides. New Zealand White Pine. Timber soft, like Weymouth Pine (*Pinus Strobus*). White to yellowish white, soft and straight grained, but not durable. A cubic foot weighs when dry 28 lb. to 35 lb. Useful for cheap furniture, packing cases &c., but even when slowly seasoned it is apt to warp or twist. New Zealand. A tree up to 180 feet in height with hanging branches, narrow pointed leaves, short and almost scale-like on the flowering shoots, and well defined annual rings.

Fig. 13. *Podocarpus Totara.*
A. Shoot with female flowers.
B. Male flowering shoot.
C. & D. Face and back views of anther.

P. ferruginea.—The Miro. Timber moderately hard, heart-wood brown, sap-wood light brown, strong, but not durable. Often figured and polishes well. A cubic foot weighs 41 lb. to 52 lb. air-dry. New Zealand. Up to 100 feet high and yielding beams 1 foot to 1½ feet square and up to 30 feet in length.

P. Totara.—Totara. Timber red, with about 3 inches of white sapwood. Strong, tough, durable. A valuable timber for general purposes. The grain is usually straight, but the wood is sometimes figured and it is then valuable for veneers. A cubic foot weighs 28 lb. to 37 lb. New Zealand. Up to 150 feet with lanceolate spirally arranged leaves, ½ inch to 1½ inches long.

P. spicata.—New Zealand Black Pine. Timber, reddish brown with about 1 inch of brownish white sapwood. Hard, tough, fairly durable, of smooth and even texture and useful for furniture and buildings. A cubic foot weighs 40 lb. New Zealand. Up to over 100 feet high, and 3 feet or 4 feet diameter, with narrow linear leaves arranged in two rows and ¼ inch to ½ inch long.

P. Thunbergii.—Yellow Wood. Timber moderately hard, yellow throughout. A cubic foot weighs 32 lb. to 38 lb. South Africa.

Fig. 14. *Podocarpus spicata.*
E. Female flower.
F. Male cone.
G. Shoot with fruits, and above, shoot with male cones.

P. elongata.—False Yellow Wood. Timber softer, like White Pine, but brownish white. A cubic foot weighs 35 lb. to 45 lb. South Africa. In external characters this and the preceding are closely related to *P. Totara*, but the leaves are about 2 inches long.

P. macrophylla.—A Japanese tree reaching 50 feet in height with ascending branches and with bright green glossy leaves, pink in the bud and when unfolding, 3 inches to 5 inches long and about ½ inch broad. The seeds are borne on a purplish violet fleshy receptacle. A decorative rather than a timber tree.

P. neriifolia.—The Prince Wood, a native of India (Himalayas), Burma and the Andamans, exceeding 50 feet in height and with whorled spreading branches. It is closely allied to *P. macrophylla*, but the leaves are larger, 4 inches to 8 inches long. The wood is soft and yellow, with very fine medullary rays, works and polishes well. Seasons without

warping or irregular shrinkage. It is a good pencil wood, and is useful for carpentry, oars, spars, masts, tea boxes, cabinet work, &c. A cubic foot weighs 42 lb. It is well worthy of trial in Southern Australasia.

DACRYDIUM.

A genus of twelve species in New Zealand, Tasmania and Malaysia. The leaves on young plants are spreading and usually narrow linear, but on older plants and on flowering branches are smaller, closely appressed and scale like.

Fig. 15. *Dacrydium cupressinum.*

H. Female shoot with fruits.
I. Young male catkin (enlarged).
J. Fruit before full development of fleshy receptacle.

Leaves on young trees over 1 inch long and on short twisted stalks .. *D. Kirkii.*

Juvenile foliage less than 1 inch long 1

1. Trees under 50 feet in height, with spreading branches *D. Colensoi.*

Trees over 50 feet in height with a compact head and pendulous branchlets 2

2. Adult foliage small, obtuse, scale-like, the scales $\frac{1}{20}$ inch long. A native of Tasmania *D. Franklinii.*

Adult foliage of small acute three-angled scales about $\frac{1}{10}$ inch long. A native of New Zealand *D. cupressinum.*

D. cupressinum.—Rimu. Heartwood red or reddish brown, sapwood yellow to yellowish brown, 3 inches to 4 inches wide. Soft but strong, and works well. Useful for furniture, cabinet work and building construction. It makes good mouldings and show case frames. A cubic foot weighs 34 lb. to 40 lb. New Zealand. Up to 80 feet or 100 feet, the foliage resembling *Podocarpus dacrydioides*, and the branches drooping.

D. Franklinii.—Huon (originally "Huron") Pine of Tasmania. Reaches 100 feet height, with a dense spreading head and pendulous branchlets. Wood yellow, close-grained, aromatic, fairly soft and light and durable. A useful, tough, but easily worked timber, but the tree is very slow in growth. Wood useful for furniture, cabinet work, carving,

boat planking, &c. It is rarely attacked by insects or borers, because of its essential oil. This oxidizes slowly, darkening furniture made of the wood. A cubic foot weighs 33 lb.

D. Kirkii.—The Manoa of New Zealand. It is 50 feet to 80 feet high. Timber reddish and durable.

D. Colensoi.—Silver Pine (*D. Westlandicum*). New Zealand tree from 30 feet to 50 feet high, with rather hard and durable timber and narrow linear-subulate leaves ¼ inch to ½ inch long. The wood is yellowish white, straight and even in grain, dense, firm and of great strength and toughness. A cubic foot weighs 40 lb. to 42 lb. Useful for sleepers, beams, construction and cabinet work. It grows from sea-level to 3,000 feet. The growth is slow, and supplies are small. The largest beams are 15 feet to 20 feet long and 12 inches to 15 inches in diameter.

GINKGO.

There is only one species of this genus, *G. biloba*, and its deciduous leaves resemble in shape and veining those of the Maiden Hair Fern. The seed is large, stalked and plum-like, with a two-edged stone. The

Fig. 16. *Ginkgo biloba.*
K. Ovules on a female shoot.
L. Shoot with fruits and foliage.
M. Young and N, dehisced stamens.

whole plant is non-resinous. This is a sacred native tree of China and Japan, often up to 100 feet high, with graceful habit and foliage. The timber is useful for carpentry and cabinet making. It is yellowish white, moderately hard, has a fine close grain, and polishes well.

PHYLLOCLADUS.

This is easily recognized by its flat cladode-like lateral leafy shoots which in the variety "glauca" of *P. trichomanoides* are simpler and obvious cladodes. There are three species only—one in Borneo, one in Tasmania (*P. rhomboidalis*), and one in New Zealand (*P. trichomanoides*).

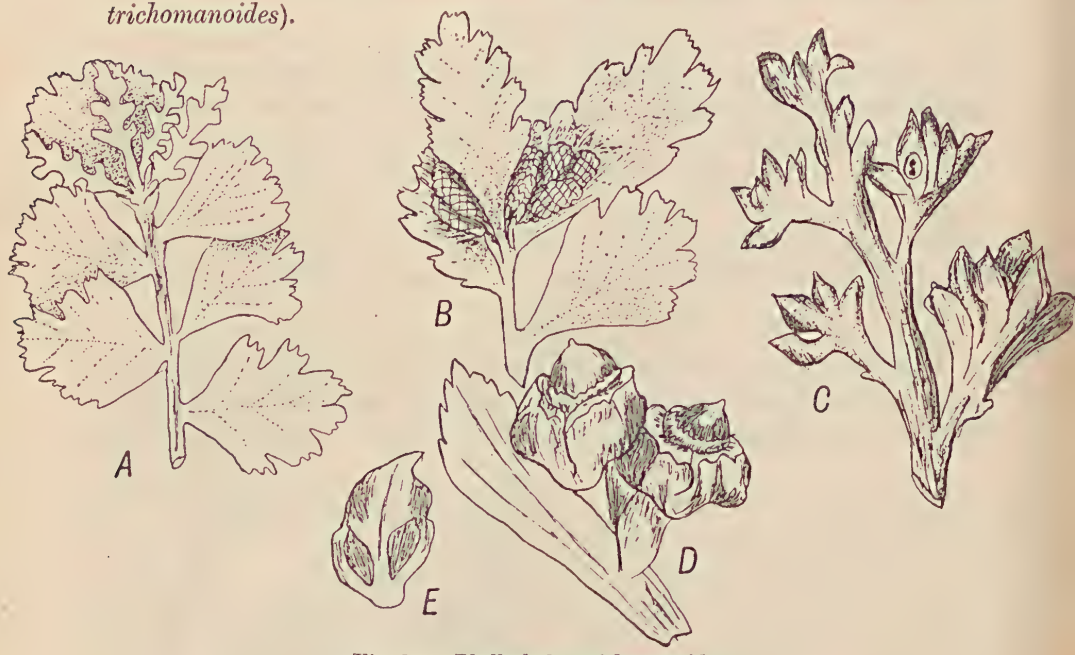

Fig. 17. *Phyllocladus trichomanoides.*

A. Female branch.
B. Male branch.
C. Flowers (enlarged).
D. Mature fruits.
E. Male scale.

P. trichomanoides.—The Celery Pine. Height 50 feet to 80 feet. The wood averages 46 lb. to 48 lb. per cubic foot, is moderately hard and durable, brownish white, strong, tough and compact. Useful for beams, spars, planks, &c. The bark contains over 20 per cent. of tannin.

P. rhomboidalis.—Tasmanian Celery Pine. This has longer and more rhomboid leaves. Timber as above. Both species become dwarfed at alpine elevations, and grow best in moist, sheltered valleys.

CEPHALOTAXUS.

There are possibly three species of this genus, but all are close together.

C. drupacea.—Up to 35 feet to 40 feet high, the leaves 2 cm. to 4 cm. long.

C. pedunculata.—Up to 35 feet to 40 feet high, the leaves 3 cm. to 5 cm. long.

C. Fortunei.—Up to 60 feet or 70 feet, the leaves 6 cm. to 12 cm. long.

The wood is similar in structure to that of *Taxus*, but the tree is grown more for decoration than for timber, and is native to China and Japan.

Fig. 18. *Cephalotaxus pedunculata.*

A. Female branch.
B. Mature seeds or "fruits."
C. Branch with male cones.

TORREYA (TUMION).

The Stinking Cedar. In habit and foliage this genus is intermediate between *Cephalotaxus* and *Taxus*. The seed is smaller than in the former, and is completely enclosed by the fleshy aril so as to resemble a drupe usually an inch or more in length. The foliage has an unpleasant smell when bruised. There are four species, two in America and two in China and Japan, but they rarely exceed 30 feet or 40 feet, and mostly inhabit mountainous regions where they form useful but slow-growing cover. The timber has not as yet come into commercial use. It

Fig. 19. *Torreya taxifolia.*

A. Female branch.
B. Male branch.
C. Branch with ripe seed "fruit."
D. Section of bud, showing two young female flowers.

is rather hard, fine-grained, firm and durable, useful for carving, furniture, and fence posts. It is pale yellow or, in the case of *T. taxifolia*, has a reddish to reddish-yellow tinge.

T. californica.—California. Attains 50 feet to 80 feet, but usually 30 feet to 50 feet. Leaves two or more inches long. It reaches 300 to 400 years of age, and averages a foot diameter per 200 years. It grows in moist, sheltered soils. The wood is bright yellow.

T. taxifolia.—Florida.—30 feet to 50 feet. Yields turpentine. Leaves stiff, leathery and sharp pointed.

T. grandis.—The "Kaya" of China. 40 feet to 60 feet. Leaves about an inch long. "Fruit" elliptical.

T. nucifera.—Japan. 25 feet to 30 feet. Seeds edible and yield oil. Leaves about an inch long. "Fruit" ovoid.

TAXUS.

A genus of some four species all closely related, of which two are important timber trees. The leaves are flat and spirally arranged, but twist to right and left. The seed is enclosed in a red pulp. The growth is always slow, and the tree may attain a great age. The wood is very strong, hard and durable, and elastic. All yews will sprout from stumps and reproduce by cuttings.

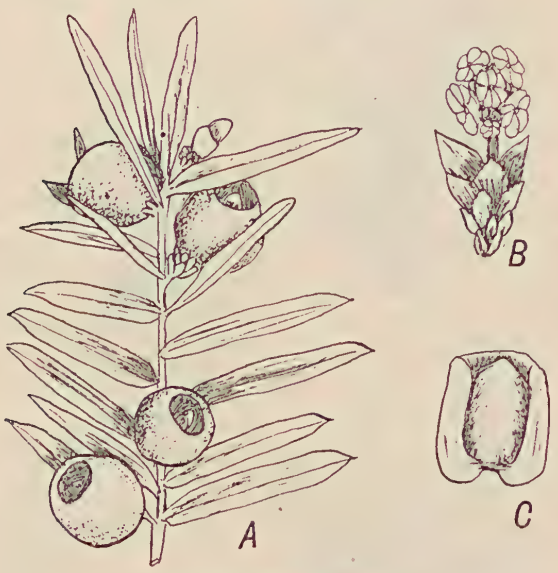

Fig. 20. *Taxus baccata.*

A. Female shoot, with seeds enclosed by fleshy aril.
B. Male shoot, with clusters of stamens.
C. Seed with half of aril removed.

T. baccata.—Yew. A native of Europe and Asia, rarely reaching over 50 feet in height and with flat, shining, dark green, linear leaves, 2 cm. to 2½ cm. long. It attains an age of 2,000 years, and is of very slow growth. The trees are often more or less unisexual, but "male" trees may develop a few fruiting branches. A cubic foot of the wood weighs 40 lb. dry and 50 lb. to 57 lb. air-dry. It is one of the hardest, heaviest and toughest of European woods, being formerly restricted by law in England to the making of bows. The heart-wood is brown, or reddish brown, with a thin layer of dirty

white sap-wood. The grain is close and even. The timber is very durable. It makes beautiful furniture and good backs for brushes. It has been used for golf clubs and axe handles, but breaks more readily than does hickory. The seeds and leaves contain the alkaloid taxin and are poisonous, but not the pulp of the red berry-like seeds.

T. brevifolia has smaller leaves (1 cm. to 2 cm. long) and is a native of North West America along the Rocky Mountains. It rarely exceeds 20 feet to 50 feet in height and 1 foot to 2½ feet in diameter, but may reach 150 to 400 years of age. The heart-wood is brownish red, and the sap-wood white or yellowish white. A cubic foot averages 40 lb. to 45 lb. It is similar to Yew wood, not quite so hard but equally tough, durable and resilient. It is used for cabinet work, canoe paddles, &c. The tree prefers moist, shady, sheltered localities.

PINOIDEAE.

Leaves and cone scales opposite or in whorls, usually few scales in the cone .. .. *Cupressineae.*

Leaves and cone scales spirally arranged and usually many scales in the cone .. .. *Abietineae* (p. 463).

CUPRESSINEAE.

Cones berry-like or drupaceous .. .. .. *Juniperae.*

Cones woody 1

1. Cone scales valvate, usually in threes .. *Actinostrobae.*

Cone scales flat or roofing, and in twos, usually four, rarely more .. .. *Thujopsilae.*

Cone scales shield shaped, in twos and more than four in all *Cupressae.*

JUNIPERAE.

Only one genus *Juniperus*, with eight or ten species, of which three yield commercial timber. Leaves needle-like or scale-like, the latter usually with a resinous gland on the back. Cotyledons needle-like, and two to six. The seeds are carried by birds. The small male and female flowers are sometimes on separate trees, wholly or mainly. Although most species are too small and slow in growth to be of much timber value, they form important forest cover for barren slopes and dry exposed situations where few other trees will grow.

KEY TO SPECIES OF JUNIPERUS.

Leaves always needle-like 1
Leaves small, scale-like and more or less appressed in the adult plant, though needle-like when young 2

1. Leaves chalky white on the upper surface, green beneath *J. communis.*
   Leaves more or equally green on both sides
   J. flaccida (and young forms of various species).
2. Adult scale leaves with a large or prominent resin gland on the back
   Adult scale leaves with a minute resin gland on the back or none
2. Branchlets prominently drooping .. .. .. *J. flaccida.*
   Branchlets not or hardly drooping 3
3. Bark on the trunk in rectangular plates .. *J. pachyphloea.*
   Bark furrowed or ridged and not in regular plates 4
4. Fruits one seeded, rarely two 5
   Fruits with more than one seed 6
5. Leaves in twos or threes closely overlapping, seed flattened at the top .. .. *J. megalocarpa*
   Leaves in twos, seed pointed at the top .. .. *J. utahensis*
   Leaves in twos, rarely threes, seed pointed, with a two lobed white scar at base .. .. *J. monosperma.*
6. Leaves in threes 7
   Leaves in twos 8
7. A tree rarely exceeding 20 feet, usually smaller .. *J. sabinoides.*
   A tree up to 50 feet in height .. .. .. *J. bermudiana.*
8. Trees usually exceeding 20 feet in height .. .. *J. virginiana.*
   Trees rarely exceeding 20 feet in height, usually less .. *J. scopulorum.*

Fig. 21. *Juniperus communis.*
Leafy branch with male cones and larger berry-like fruits

J. communis.—The Common Juniper is a shrub or small tree, up to 20 feet in height, a native of Europe, North America and North Asia, with dark brown berry-like fruits up to ¾ cm. diameter and with a bluish bloom. The leaves are needle-like, with a white upper surface, and are in whorls of three. Each leaf lasts for five to six years. Timber brown to brownish-yellow, with well-defined yellowish-white sap-wood. A cubic foot weighs 33 lb. dry to 40 lb. air-dry. It is strong, compact, tough, hard and durable, resisting the attacks of insects. Useful for turnery. The tree is slow in growth, the annual rings being very narrow, but attains a great age. Trees 12 inches to 16 inches in diameter may be 100 to 400 years old. Far north and at high elevations, it is dwarfed to a foot in height.

J. virginiana.—The Pencil Cedar. Leaves scale like and in whorls of two usually. A native of North America. Fruits small, dark purple, with a bluish bloom. Tree up to 40 feet or 60 feet, or on sterile, rocky soils dwarfed to a shrub. Heart-wood red, sap-wood white and sharply defined. Annual rings distinct, the autumn wood darker. No resin canals. The growth is slow. Dry weight 22 lb. per cubic foot to 35 lb. air-dry weight. Rather soft (like deal), with a sweet fragrant smell. Not strong, and rather brittle but easily worked. Used for pencils, cigar boxes, &c.

J. bermudiana of the West Indies (Bermuda, &c.) yields a similar timber. Its fragrant timber was the original source of cedar wood for pencils, until it was cut out. It reaches 50 feet in height and has the young leaves needle-like and in threes, but the old foliage appressed and scale like. It is sensitive to frost. The African Pencil Cedar is *J. procera*, which has a darker, harder, more brittle and denser wood than *J. virginiana*. A cubic foot weighs 40 lb. It is useful for panels and moulding when obtainable.

J. occidentalis is closely related, and has nearly similar but paler and finer grained, less fragrant wood, very durable, but soft and brittle. It has the leaves in alternating pairs, and is found from California to West Canada in exposed situations on high mountain slopes. It may reach 500 to 800 years of age, and the short trunk may reach 4 feet in diameter. In sheltered localities it may be 50 feet to 60 feet high and 2 feet to 3 feet diameter, with an age of 200 to 300 years. Leaves as in *J. bermudiana*. Berries dark purple with a whitish bloom.

ACTINOSTROBAE.

The scales in the ripe cone form an open cup.

A. Cone scales smooth, equal, six, tapering to a terminal point. Leaves scale-like or more rarely needle-like. *Actinostrobus*.

B. Cone scales four to six, in twos or threes, the outer set usually smaller, or with a dorsal point on the back behind the tip, or rough on the back. Leaves as above. *Callitris*.

C. *Fitzroya.*—Resembling *Callitris*, but the cones smaller and only the upper set of scales fertile.

Actinostrobus pyramidalis.—A native of South and West Australia, is the only species known of the genus. It is merely a densely branched shrub.

Fig. 22. *Actinostrobus pyramidalis.*

Open female cones, the valves equal.

Fig. 23. *Fitzroya Archeri.*
Leafy branch with terminal female cones.

Fitzroya has two species—one, *F. Archeri*, is a mountain shrub in Tasmania; the other, *F. patagonica*, is a tall tree of over 100 feet in height in Chili and Patagonia, usually on swampy ground or moors, and at high elevations reduced to a shrub. Its timber has not found much economic use. It is light, reddish, durable, splits freely, and is used for shingles. A cubic foot weighs 32 lb.

CALLITRIS.

A genus of about fifteen species mainly in Australia, but also in Africa. The more important Australian species not already mentioned are *C. rhomboidea* and *C. australis*. The former is a tree up to 80 feet or more in height, with terminal drooping branchlets and cones 1.5 cm. diameter. The latter has erect branchlets and cones up to 3 cm. diameter. Of the African species, one *C. quadrivalvis*, is a shrub of 15 feet to 20 feet, rarely a small tree, found in the mountains of North-West Africa (Atlas Mountains, &c.). It yields sandarac resin, which was used by the Egyptians to embalm mummies, and tables made of the Birdseye butt wood were sold in Pliny's time. A second species is the South African Cedar (*C. juniperoides*), a tree 30 feet to 40 feet high, with the leaves scale-like on the fertile and needle-like on the sterile shoots, the cones 2 cm. to 2½ cm. diameter, when open each valve with one to three seeds, and the seeds with a narrow wing. Timber light brown or yellow, 36 lb. per cubic foot when dry, moderately soft (like deal). The grain is close and regular, and the medullary rays fairly prominent. The third South African species, *C. arborea*, is of even greater size, and usually grows about 3,000 feet above sea level.

Fig. 24. *Callitris robusta* var. *glauca*.

Young female cones and an older open one showing the alternating large and small scales or valves.

THUJOPSIDAE.

Leaves small, scale-like, usually closely appressed, branches often dorsi-ventral.

Female cone scales short and broad, each with four to five seeds .. *Thujopsis.*
Female cone scales longer than broad, the fertile ones with one to three seeds .. 1

1. Female cone scales four, the upper pair fertile .. *Libocedrus.*
   Female cone scales six to eight, two or three of the upper or middle pairs fertile .. .. *Thuja.*

THUJOPSIS.

A genus with one species (*T. dolabrata*), native to Japan, and of which several varieties are grown in gardens. The parent form grows to a tall tree 40 feet to 50 feet high, with flattened branches closely beset with small pointed leaves, with their bases adherent to the flattened branches. Cones rounded and 1·5 cm. diameter. The timber is not used in commerce. It is reddish, rather hard and durable.

Fig. 25. *Thujopsis dolabrata.*
Branch with male cones and one female cone. Also a single carpellary scale with ovules.

LIBOCEDRUS.

The seeds are easily recognized by having the wing developed more on one side of the seed than on the other. A genus of eight species, all large forest trees, distributed from Chili and California, through New Zealand to New Guinea, Japan, and China. The leaves are scale-like, and the small cones open like a valvate pod. Each has two small sterile basal scales, two fertile ones, and two fused to form a central septum between the two large fertile scales. The timber is valuable.

L. chilensis is a native of the Andes in Chili, and attains a height of 80 feet to 100 feet, usually on mountains at 1,000 feet to 6,000 feet. The branchlets are silvery white beneath. Wood pale, light and soft, but strong. Useful for furniture, building and cabinet work. The tree is sensitive to extreme cold and exposure.

L. decurrens.—The White Cedar. California, Oregon and the western edge of the Rocky Mountains. It has the branchlets light green beneath, darker green above. It attains a height of 80 feet to 100 feet or more, with a diameter of 3 feet to 6 feet and an age of 500 to 800 years. A common

Fig. 26. *Libocedrus decurrens* and a cone of *L. Doniana.*
Branch with scale leaves and three female cones. The cone of *L. Doniana* has horned cone scales.

size is 50 feet to 80 feet and 2½ feet diameter. Wood, pale to brownish yellow, with a white sap-wood, light, fragrant, fairly durable. Old trees are often damaged by *Polyporus amarus*, so that the broad buttressed base may be quite hollow.

L. Doniana.—The Kawhaka Cedar is a native of New Zealand, 50 feet to 100 feet in height. It has the branchlets nearly equally green on both sides and a long curved point on the back of each female cone scale. It is closely related to the second New Zealand species *L. Bidwilli*, the New Zealand Cedar. This has brownish red timber with a paler sap wood. A cubic foot weighs 28 lb. to 30 lb. It is moderately hard, straight in grain, easily worked, fairly strong, durable and has resin pores in the wood resembling the vessels of a dicotyledonous tree. It is useful for bridge building, telegraph posts, fencing posts, rails and furniture.

L. tetragona of the Andes (2,000 feet to 8,000 feet) has a soft, light, pale reddish, resinous and durable wood. It reaches 60 feet to 80 feet. The wood is used in Chili for weatherboards and shingles.

THUJA.

A genus of four species native to Japan, China, and North America. The leaves are scale-like and closely appressed to the stem in the adult plant. Each leaf has a minute gland or pit on the back. The cones have four pairs of thin decussate scales each with two seeds and the basal pair is sterile, i.e., each cone has usually twelve seeds. The seeds are winged and the wings equal.

KEY TO SPECIES OF THUJA.

Cones scale with a short point below the apex. Branchlets more or less horizontal with distinct upper and lower sides 1

Cone scales with a long horn below the apex. Branchets expanded in a vertical plane, the two sides alike .. .. *T. orientalis.*

1. Leaves green beneath .. .. .. *T. occidentalis.*

Leaves with whitish triangular spots beneath 2

2. Cone scales oblong, eight to ten, usually the middle three pairs fertile. A tall tree over 30 feet .. .. .. *T. plicata.*

Cone scales oval, eight, usually the two middle pairs fertile. A small tree, under 30 feet .. .. *T. japonica.*

T. occidentalis, the Arbor Vitae, a native of North America, reaches a height of 50 feet to 80 feet, and *T. plicata*, the Western Cedar is of similar range but is a larger tree, (100 feet to 200 feet with a diameter of 5 feet to 10 feet and an age of 500 to 1,000 years), has brighter green branchlets with broader and even more closely set scale leaves. The aromatic wood of both species is brown to reddish but the sap-wood is nearly white. A cubic foot weighs 25 lb. to 27 lb. when seasoned and 19 lb. to 22 lb. when dry. It is rather soft and brittle and not very strong, but is very durable even in the ground. The leaves turn brown in

winter and green again in spring. Both species grow in wet places, banks of rivers, &c.

T. orientalis, a native of China and Japan, is less a timber than a decorative tree, many varieties being commonly grown in gardens and in some the winter colouration is very striking. The garden form with projecting needle-like leaves known as *Retinospora juniperoides* is obtained by striking cuttings from seedlings. Older cuttings may give rise to plants with mixed adult and embryonic foliage.

T. plicata (*T. gigantea*, *T. Lobbii*, *T. Menziesii*) of North-West United States is the Yellow Cypress and attains 50 feet to 150 feet. Timber light, soft, yellow, fairly durable, useful for furniture and house fittings. Resists cold.

Fig. 27. *Thuja orientalis.*

Branch with scale leaves and a ripe and an open female cone.

CUPRESSAE.

Each cone scale with many seeds (up to ten or twenty), cones ripening in two years .. .. .. *Cupressus.*

Each cone scale with two, rarely one, four or even five seeds, cones ripening in one year, branches flattened and dorsiventral .. .. *Chamaecyparis.*

CUPRESSUS.

Cones rounded with stalked shield shaped scales, usually separating in the second year and allowing the seeds to slip out between them. A genus of about twelve widely distributed species characteristic of warm temperate regions. Absent from Africa and South America. The young plants usually have needle-like foliage which later assumes the form of short scale-like, pointed or closely appressed small leaves with minutely toothed margins. Old cones very persistent. Seedlings with three to five cotyledons. Seeds without wings. Wood very durable and aromatic. Embryonic Retinospora forms are common in garden culture.

KEY TO CUPRESSUS SPECIES.

Terminal branches slender, and more or less drooping 1

Terminal branches erect or spreading, usually short and stout .. 3

1. Cones practically sessile, with eight to ten mucronate scales and over 1 cm. diameter .. .. *C. torulosa.*

Cones distinctly stalked 2

2. Cones over 1 cm. diameter .. .. *C. lusitanica.*
   Cones under 1 cm. diameter .. .. *C. funebris.*
3. Cones 1 cm. diameter, or less, usually with six scales *Chamaecyparis Lawsoniana.*
   Cones 1 cm. to 2½ cm. diameter with six to eight scales 4
   Cones over 2½ cms. diameter with eight to fourteen scales .. 8
4. Bosses on cone scales prominent or curved 5
   Bosses on cone scales not prominent or if prominent, straight .. 7
5. Cones oblong .. .. *C. McNabiana.*
   Cones rounded or globose 6
6. Bark furrowed, leaves without pits .. .. .. *C. arizonica.*
   Bark smooth but scaly, leaves with glandular pits .. *C. glabra.*
7. Bosses on cone scales blunt .. .. *C. Goveniana.*
   Bosses on cone scales pointed .. .. .. *C. Benthami.*
8. Leaves glandular .. .. *C. sempervirens.*
   Leaves hardly glandular .. .. *C. macrocarpa.*

C. sempervirens.—The Mediterranean Cypress reaches 50 feet to 60 feet or rarely 100 feet high and an age of 2,000 years. Wood very durable, fragrant and proof against insects, but of slow growth and most suitable for coffins. It is light brown, hard and close grained. A cubic foot weighs 25 lb. to 30 lb. when dry. The cones are 2 cm. to 3 cm. long and have eight to ten fruiting scales. The branches are usually vertically ascending and more or less closely appressed, giving a somewhat " Poplar " habit.

C. Goveniana.—Gowen Cypress, a small tree rarely over 20 feet to 30 feet high, with dense durable yellowish brown faintly aromatic wood, but useful only as a cover on dry, sterile, wind swept barrens and rocky slopes or summits. It grows to an age of 200 years and in 80 years averages a foot in diameter.

C. funebris.—The Weeping Cypress, has a broader crown with drooping branches and smaller cones with six to eight fruiting scales. It originally came from China. It is of slow growth and suffers when exposed to cold dry winds. The wood is red and fragrant.

C. arizonica.—The Arizona Cypress, may attain 50 feet to 80 feet but is usually smaller and is very slow in growth, each foot in diameter may represent 100 years growth. The oldest trees (400 years) may not exceed 3 feet in diameter. The wood is soft, light and straight grained, the heart-wood pale brownish yellow, the sap-wood pale yellow. The supplies are small and it is little used. *C. glabra* is similar in regard to its general characters, distribution and timber.

C. torulosa.—The Himalayan Cypress, reaches 150 feet high and has cones 1½ cms. diameter, with ten fruiting scales. The leaves are very small and smooth and are arranged in four rows when adult, but somewhat spreading when young. It is resistant to cold but not to severe

frost. The wood has a smooth straight grain, and is a pale salmon to yellow colour. It is durable and fragrant. The annual rings are prominent with a dark vein of autumn wood. A cubic foot weighs 38 lb.

C. macrocarpa.—Monterey Cypress, has much larger cones, 2 cm. to 3 cm. diameter with ten to twelve scales and slightly longer than broad. It may reach 50 feet to 100 feet in height with an age of 200 years and a diameter of 3 feet. It is a useful shelter tree and is native to California. It has very bright green foliage and small very closely appressed scale leaves. In all the foregoing, the timber is useful, when obtainable, but the annual timber increment is small, although the early growth in height is rapid. The wood is yellow-brown with reddish streaks, dense and durable with a faint "cedar" odour. The trees are more garden and shelter trees than timber trees. The lower branches spread widely forming a broad cone and giving good shade and shelter.

Fig. 28. *Cupressus macrocarpa.*
Branch with scale leaves and ripe but unopened female cone.

CHAMAECYPARIS.

A genus of five species found in North America and Japan with a hard and heavy odourless wood, but sometimes termed "cedars." Often grown in gardens either as adult trees or as the juvenile forms known as "Retinospora." These have projecting needle-like leaves and usually do not fruit but may be propagated by cuttings. The seedlings have two cotyledons and the seeds have a thin membranous wing or margin. The cones are smaller than those of *Cupressus* and ripen in one year. The branches are compressed and dorsiventral.

KEY TO SPECIES OF CHAMAECYPARIS.

1	Wood with a strong aromatic, but unpleasant smell	*C. formosensis.*
	Wood almost or entirely odourless	1
1.	Fruiting cone scales four	*C. nutkaensis.*
	Cones scales eight to ten	*C. obtusa.*
	Cone scales usually six	2
2.	Cones about 1 cm. diameter	*C. Lawsoniana.*
	Cones ¾ cm. diameter or less	3
3.	Leaves with whitish lines beneath	*C. pisifera.*
	Leaves green beneath	*C. sphaeroidea.*

C. Lawsoniana approaches *Cupressus* vegetatively. It may reach 90 feet to 150 feet in height, has bright green branchlets, and small cones hardly 1 cm. diameter, with usually six fruiting scales. The male cones are bright crimson. A horizontally branching variety is used for hedges. *C. Lawsoniana* is native to North California and Oregon. Timber pale yellow to white, close grained, but fairly soft, strong, very durable and fragrant. Somewhat difficult to plane smooth, and, except with a very sharp blade, the fibres cling to the tool. Useful for furniture and general purposes. A cubic foot weighs 33 lb. The wood contains resin but has no resin passages.

C. nutkaensis (*C. nootkatensis*).—The Sitka Cypress has cones about 1 cm. diameter with four fruiting scales and attains a height of 90 feet to 100 feet. It resembles *C. Lawsoniana* in habit but has paler green foliage and yellow male cones. The wood is light brown to light yellowish red with a paler sap-wood and as in other species contains a strong diuretic principle. A cubic foot weighs 20 lb. to 22 lb. It is durable, easily worked and has a handsome grain, but is not very strong. It extends from Alaska and British Columbia to Oregon. It resists cold but requires plenty of moisture and will then grow on poor soils.

C. formosensis.—The Formosa Cedar has light yellow to yellowish-brown non-fragrant, but aromatic wood, soft, straight grained, working smoothly and suitable for sounding boards. It has narrow well-defined annual rings and sometimes resembles the wood of the Swamp Cypress (*Taxodium distichum*). This would be a valuable timber if regular supplies could be obtained. A cubic foot weighs 28 lb.

C. sphaeroidea (*C. ericoides*).—S.E. U.S.A. A tree up to 70 feet or a compact shrub of which varieties with coloured foliage are grown in horticulture.

Fig. 29. *Chamaecyparis obtusa.*
Branch with scale leaves and single ripe but unopened female cone.

C. pisifera, the Savara of Japan, has cones $\frac{3}{4}$ cm. diameter with six fruiting scales. It reaches 80 feet and over 3 feet diameter. Wood used in cooperage. The juvenile form is known as *Retinospora squarrosa.*

C. obtusa, the Hinoki of Japan, has cones 1 cm. diameter with eight to ten scales and attains a height of 60 feet to 70 feet and a diameter of 3 feet. Wood pale, with wavy, darker streaks, durable, fragrant, close grained, easily worked. A cubic foot weighs 22 lb. to 23 lb. The annual rings are very narrow and the medullary rays very fine. The juvenile form is *Retinospora*

lycopodiodes. It can be propagated by layers. The timber is much valued in Japan but is not exported. It is well worth planting.

ABIETINEAE.

A. Each female cone scale simple and with a single seed *Araucarae.*

B. Each female cone scale double, having a smaller bract scale and a larger placental scale bearing two or more seeds .. 1 & 2

1. Two ovules to each scale, the ovule inverted (anatropal) so that the aperture (micropyle) is at the base of the scale *Abietae.*

2. More than two ovules to each scale, or if two the ovules straight (orthotropal), or the placental seed-bearing scale hardly differentiated from the bract scale .. .. *Taxodae.*

ARAUCARAE.

Cones large, compact and requiring two years to ripen.

Leaves narrowed at base and apex. Seed free from the cone scale .. .. *Agathis.*

Leave broad at the base tapering to the tip. Seed fused with the cone scale .. .. *Araucaria.*

AGATHIS.

A genus of two or three species extending from New Zealand and Fiji to the Philippines, Malay Archipelago and Queensland.

A. australis (*Dammara australis*). The Kauri of New Zealand. Leaves about 3 cm. to 6 cm, long and 2 cm. broad. A tall tree exceeding 100 feet to 150 feet in height, and yielding Kauri resin, lumps of which are often found buried in the soil in Kauri forest as well as an exudation on the trunks of the living trees.

A. robusta (the Queensland form of *A. australis*) is often separated as a distinct species. The timber of both species is moderately hard, yellowish-brown in colour with a straight even grain, works freely, is strong and durable. Well suited for masts, yards, planks, benching. flooring, decking,

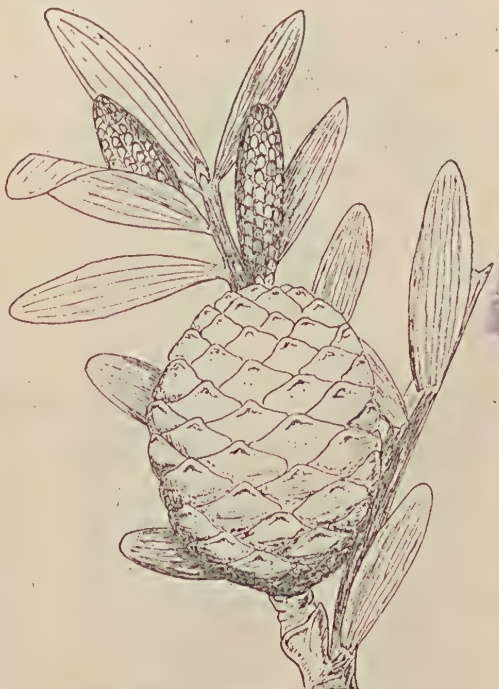

Fig. 30. *Agathis australis.*
Branch showing flattened leaves, two male cones and a ripe but unopened female cone.

furniture and general purposes. It works easily and takes a high polish. A cubic foot weighs 30 lb. to 39 lb. The shrinkage in seasoning is small. The annual rings are prominent but not the medullary rays. The latter give a fine mottled figuring to the radial section. For its density it is a very strong and even timber. The transverse breaking strain varies from 150 lb. to 130 lb. per square inch. On the whole the New Zealand Kauri seems to be slightly superior to the Queensland, and although they are two of the most valuable timber trees known both are in rapid process of extinction. At the present rate Kauri may cease to be obtainable in commercial quantities within 25 years. No appreciable replanting has been done.

A. dammara.—The Dammar tree of the Malay Archipelago and Philippines. Leaves twice as large as the above and cones 10 cm. diameter instead of 5 cm. or 6 cm. The tree attains 100 feet in height. The timber is little used in commerce, but the resin is a valuable commercial product. It flows freely and often forms masses of up to a hundredweight.

ARAUCARIA.

A genus of some ten species found in Australia, South America and Norfolk Island.

	Leaves somewhat like short four-edged needles but scale-like on the fertile shoots. Cone scales winged on both edges ..	1
	Leaves flat, cone scales not winged	3
1.	Cones up to 15 cm. diameter	*A. excelsa.*
	Cones less than 12 cm. diameter	2
2.	Leaves crowded sharply pointed	*A. Cunninghami.*
	Leaves closely set, but obtuse	*A. Cooki.*
3.	Leaves more or less two-rowed	*A. Bidwilli.*
	Leaves not two-rowed	4
4.	Leaves obtuse	*A. Rulei.*
	Leaves sharp pointed	5
5.	Leaves an inch long or more. Cones 8 in. diameter	*A. brasiliana.*
	Leaves very hard and sharp pointed, under 1 inch length. Cones under 8 inches	*A. imbricata.*

A. excelsa. The Norfolk Island Pine. A tree 150 feet to 200 feet high, with the branches in whorls of five and with globular, compact cones 4 inches to 5 inches in diameter. The timber resembles a straight grained deal, but is stronger and more durable and is valuable for ship and house building, as well as for plain furniture. Leaves narrow, curved and sharply pointed.

A. Cunninghami. The Hoop Pine. A tree often exceeding 100 feet to 150 feet, yielding a pale, valuable, straight grained, moderately hard timber, easily worked, and useful for furniture, boxes, cases, &c. A native of Queensland and North-Eastern New South Wales. Leaves needle-like and four angled, rigid and sharp pointed.

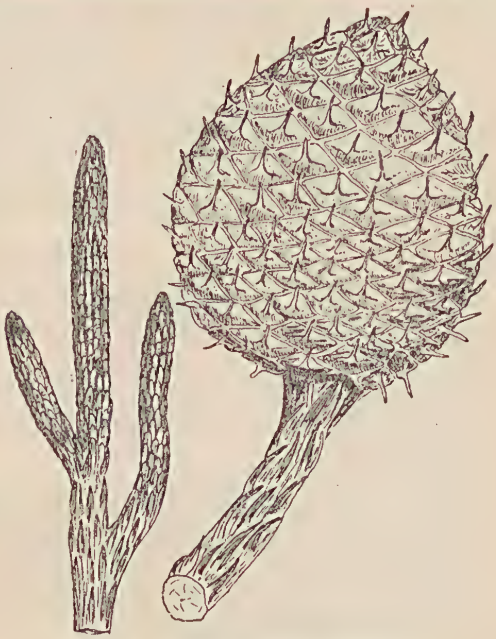

Fig. 31. *Araucaria Cunninghami.*
Three male cones and a ripe but unopened female cone with needle-like leaves on the stalk.

A. Cooki. The New Caledonia Pine. A tall straight tree reaching 200 feet in height, and useful for poles, shafts, masts, &c. Leaves short, pointed, spreading.

A. Bidwilli. The Bunya Pine. A native of Queensland, attaining a height of 150 feet. The cone somewhat resembles a pineapple and is 10 inches to 12 inches broad. Timber similar to hoop pine, but not quite so valuable. Leaves in two nearly horizontal rows, ovate lanceolate, leathery and deep glossy green.

A. Rulei.—A native of New Caledonia, attaining a height of 50 feet with horizontal branches and hanging branchlets. Timber little used or known.

A. brasiliana. The Brazilian Pine. A tree native to Brazil and 100 feet to 150 feet high. The wood is valuable, yellowish-white, and somewhat resembles deal, but is rather harder and more durable. The seeds are edible. Leaves spreading, deep green, oblong lanceolate and drawn out at the tip.

A. imbricata. The Monkey Puzzle. A native of Chili, resembling the preceding in its timber, its pale resin and its edible seeds, but with harder and more closely set leaves and rarely much exceeding 100 feet

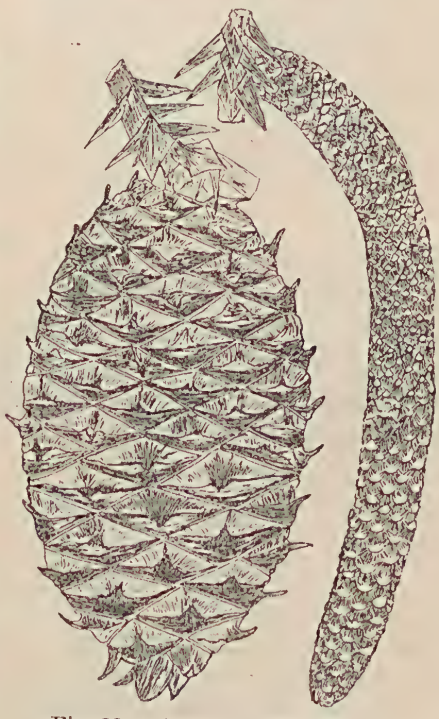

Fig. 32. *Araucaria Bidwilli.*
A male and a female cone.

in height. This and the preceding species form large homogeneous forests, whereas the Australian araucarias mostly occur in mixed forests. When planted in Australia these two species grow more slowly than the native species. The wood of *A. imbricata* is yellowish to white (sap-wood) and resembles that of a smooth, straight grained deal, but has no resin canals. A cubic foot weighs 20 lb. to 23 lb. when dry. The female cone is nearly spherical and 6 inches to 8 inches in diameter. The tree stands severe cold, and requires a moist well-drained soil.

ABIETAE.

Seeds two on each cone scale. Scales in male cone each with two anthers. Pollen grains almost always with two air bladders.

Shoots of unlimited and of limited growth (dwarf shoots, with clustered leaves or with two to five needles as in Pine needles) 1

Shoots of one kind only 4

1. The needle foliage leaves borne on the dwarf shoots, and only scale leaves on the ordinary shoots .. .. *Pinus.*

   The needle leaves borne on both ordinary shoots and in clusters on the dwarf shoots 2

2. Needles evergreen, cones taking two to three years to ripen *Cedrus.*

   Needles deciduous, cones ripening in one year 3

3. Cone scales persistent .. .. *Larix.*

   Cone scales deciduous .. .. *Pseudo-larix.*

4. Needle leaves quadrangular, fruiting cones pendent with persistent scales .. .. *Picea.*

   Leaves narrow and linear, but flat rather than needle-like .. 5

5. Fruiting cones pendent with persistent scales .. *Tsuga.*

   Fruiting cones erect with deciduous scales .. .. *Abies.*

PINUS.

A genus of some 70 species characteristic of northern temperate regions and practically absent from the Southern Hemisphere, but extending to the Malay Archipelago and across the equator to Java. The needle leaves are in clusters of usually two to three on the dwarf shoots, rarely up to seven or only one. The genus yields some of the most valuable soft woods, and also resin from exudations and turpentine by bleeding. The crude turpentine on distilling yields ordinary turpentine and leaves a residue of resin.

There are two main sections of the Pines, in one, the *pinaster* section, the ends of the fruiting scales in the female cones are expanded in pyramidal fashion with a central cone or umbo. In the second or *strobus* section, the cone scales are flatter with a terminal umbo and usually overlap loosely, each scale being somewhat like the half of a *pinaster* scale.

GENERAL KEY TO THE COMMONER PINES.

Cone scales broadened at the ends pyramidal fashion with a central cone or umbo. Needles 5, 3, 2, or 1; each with one or two vascular bundles, "Pinaster" 4

Cone scales flattened, usually overlapping loosely and with a terminal umbo at the margin. Needles in fives, each with one vascular bundle, "Strobus" 1

Needles mostly in fours, but on the same tree also in threes and fives .. .. *P. quadrifolia.*

1. Cones long and slender. Seeds with a long wing 2
   Cones ovate, seeds wingless or with a short wing 3
2. Cones under 6 inches .. .. *P. Strobus.*
   Cones over 6 inches long 2A
2A. Leaves slender, branchlets usually smooth .. .. *P. monticola.*
   Leaves stout, branchlets more or less hairy .. *P. Lambertiana.*
3. Seeds wingless, resin ducts in the parenchyma of the leaf *P. cembra.*
   Seeds with a narrow wing, resin ducts peripheral, i.e., just beneath the epidermis .. .. *P. parviflora.*
4. Needles mostly or all single .. .. .. *P. monophylla.*
   Needles in twos, threes, or fives 5
5. Needles regularly in twos, usually or mostly under 20 cm. long .. 6
   Needles all or mostly in threes, rarely in fours or fives, usually under 20 cm. long 19
   Needles in fives, rigid, dark green 20 cm. to 30 cm. long *P. Torreyana.*
   Needles in twos, rarely in threes, 7 to 14 cm. long, cones sessile, flat based, 4 or 5 cm. long .. .. .. *P. mitis.*
6. Resin canals just beneath the epidermis of the leaf. Cones beneath the branches 7
   Resin canals in the parenchyma of the leaf. Cones at the bases of the whorls of branches 13
7. Leaves 2 cm. to 8 cm. long 8
   Leaves 8 cm. to 20 cm. long 10
8. Umbo of cone scales obtuse .. .. *P. divaricata.*
   Umbo of cone scales pointed 9
9. Pointed spine of umbo stout and straight .. .. *P. clausa.*
   Pointed spine of umbo stout and curved .. .. *P. pungens.*
   Pointed spine of umbo slender and curved .. .. *P. contorta.*
10. Winter buds pale or silvery .. .. .. *P. Thunbergi.*
    Winter buds brown 11
11. Seeds dark or black, cone scales with a dark triangular spiny umbo *P. muricata.*
    Seeds grey or greyish-brown, umbo obtuse or acute, but hardly spiny 12
12. Leaves hardly twisted, dark green, 10 cm. to 15 cm. long, seeds grey, umbo flat, obtuse or shortly pointed (*P. austriaca*) *P. Laricio.*
    Leaves usually twisted, glassy green, 12 cm. to 20 cm. long, cone scales with a prominent triangular acute umbo. Seeds greyish-brown. (*P. maritima*) .. .. *P. pinaster.*

13. Leaves all or mostly 2 cm. to 7 cm. long 14
Leaves all or mostly 7 cm. to 20 cm. long 15

14. A tree over 30 feet high. Cone scales with a small obtuse umbo *P. sylvestris.*
A small tree or shrub under 30 feet. Umbo light grey within a dark ring .. .. *P. montana.*

15. Leaves rigid acute .. .. *P. Pinea.*
Leaves slender or flexible, acute or obtuse 16

16. Branchlets with a waxy bloom .. .. .. *P. densiflora.*
Branchlets without a waxy bloom 17

17. Leaves mostly under 10 cm. long .. .. .. *P. halepensis.*
Leaves mostly over 10 cm. long 18

18. Leaves dark green .. .. *P. resinosa.*
Leaves light green .. .. *P. Massoniana.*

19. Cones all or mostly over 18 cm. long 20
Cones all or mostly under 18 cm. long 22

20. Leaves slender flexible .. .. *P. Sabiniana.*
Leaves stout acute 21

21. Winter buds resinous. Leaves dark bluish green .. *P. Coulteri.*
Winter buds not resinous. Leaves pale bluish green .. *P. Jeffreyi.*

22. Leaves all or mostly under 12 cm. long 23
Leaves all or mostly over 12 cm. long 24

23. Cones practically sessile, usually several together .. *P. rigida.*
Cones shortly stalked, usually single, leaves bright green, umbo small .. .. (*P. insignis*) *P. radiata.*
Cones shortly stalked, usually in clusters. Leaves yellowish or bluish green, umbo prominent .. .. .. *P. tuberculata.*

24. Umbo obtuse 25
Umbo with a straight or curved point or prickle 26

25. Cones somewhat cylindrical .. .. .. *P. canariensis.*
Cones more conical .. .. *P. longifolia.*

26. Cones dull brown .. .. *P. palustris.*
Cones shining light reddish or yellowish brown 27

27. Seeds over $\frac{3}{4}$ cm. long, cones more conical .. .. *P. Taeda.*
Seeds under $\frac{3}{4}$ cm. long, cones more ovate .. .. *P. ponderosa.*

Strobus Section.—This comprises about 20 species, and the dwarf shoots usually have five needle leaves, which often are spreading in summer but contracted or drooping in winter.

There are three important species—

P. Cembra. Alpine Pine. Cones erect or projecting laterally, 5 cm. to 7 cm. long. Needles 8 cm. to 12 cm. long. Seeds unwinged. An alpine tree attaining 60 feet to 70 feet in height and extending from the Alps to North Siberia. The wood is white, soft, fine grained and fragrant, and is favored by wood carvers and cabinet makers. The seeds are edible.

P. Lambertiana. The Sugar Pine. Cones pendent up to 12 inches to 20 inches in length and 3 inches to 4 inches diameter, narrow, with overlapping scales. Needles 7 cm. to 12 cm. long. It is a native of North America (California, Oregon, &c.), attaining giant dimensions (150 feet to 200 feet and 3 feet to 7 feet diameter and 300 to 500 years of age) and

Fig. 33. *Pinus Lambertiana.*
Female cone and needles of a single dwarf shoot (both much diminished).

Fig. 34. *Pinus Strobus.*
Female cone and needles of a single dwarf shoot (both nearly natural size).

usually occurring with other species such as Redwood and *P. ponderosa.* The resin has a sweetish taste and the large nutty seeds are edible. The growth is slow when planted, usually under a foot a year. The timber is yellow or yellowish-brown with paler stripes. It is fairly soft, works well, and is valuable for planks, boards, tables, &c. A cubic foot weighs 25 lb. dry and up to 52 lb. green. The *P. monticola* of California to Washington differs in having smaller (5 inches to 10 inches) pointed cones, a height of 90 feet to 100 feet and a diameter of 3 feet to 4 feet when 200 to 500 years old, and paler, but equally valuable wood. It is practically the western form of *P. Strobus,* and is known in America as the Western White Pine, and has slightly shorter needles (5 cm. to 10 cm.).

P. Strobus. Weymouth Pine (Eastern White Pine). A native of North America from Canada to the Alleghanies. It has pendent cones not exceeding 6 inches long with loose overlapping scales. Leaves 7 cm.

to 12 cm. long and winged seeds. It attains a height of 100 feet to 150 feet, and has a rather soft brownish or straw coloured wood with a smooth, even, straight grain marked with fine dark longitudinal lines, the resin ducts. Medullary rays very narrow. Annual rings prominent, although the transition from spring to summer wood is gradual. It works easily and is much used for house building, &c., but is not very strong or very durable except under cover. A cubic foot weighs 20 lb. to 30 lb. It is sometimes known as the Yellow Pine, or White Pine. It was formerly very abundant, but good trees are now scarce and very little replanting has been done. It was formerly one of the most valuable commercial soft woods.

P. quadrifolia. Four-leaf Pine. A tree 15 feet to 30 feet high, of slow growth (a foot in diameter in 100 years) and hence of little timber value. It is a native of California, grows on low or high elevations and in poor dry soils. It might be useful for cover in dry Mallee districts. The same applies to the Pinon of California, *P. monophylla*, Single-leaf Pine, which has similar properties but is even more drought resistant.

Pinaster Section.—A. *Unifolia* sub-section. Dwarf shoots mainly with one needle.

Fig. 35. *Pinus monophylla.*
Open female cone.

P. monophylla. Nut Pine. A native of California. Slow in growth, 20 feet to 40 feet high, cones 5 cm. to 6 cm. long, seeds large, edible, wingless. On the older shoots the needles may develop in twos or even threes.

B. *Pinea* sub-section (includes about 20 species). Dwarf shoots mainly with two needles.

P. sylvestris. Scotch Pine or Baltic Pine. A native of North Europe and Asia, attaining a height of 80 feet to 130 feet and an age of 100 to 120 years, with dark green needles 2 inches to 3 inches long. In luxuriant specimens grown in Victoria the needles are often an inch or so longer. The cones are shortly stalked and curve sharply backwards by the autumn of the second year when they ripen and shed their seeds in the following spring. The tree stands cold and exposure well. The timber is reddish-brown with a whitish sap-wood, with prominent rings. It is often known as yellow deal or red deal, even and straight in the grain, tough, elastic, and easily worked, but not very durable in the ground. A very valuable soft wood, fairly strong and durable under cover. A cubic foot weighs 20 lb. dry and 52 lb. green. It is much used for flooring and match boards. Its growth in Victoria is less rapid

than that of *Pinus radiata*. The resinous exudation from the bark and also partly from the wood yields turpentine when distilled and the residue is bow-rosin (*colophonium*).

P. Pinea. Stone Pine. A native of the Mediterranean regions, attaining a height of 60 feet to 100 feet often with a rather spreading umbrella-like crown. Needles 4 inches to 6 inches long or more. Cones 10 cm. to 15 cm. long, ripening in the third year and shedding large hard shelled edible seeds with only a narrow winged rim. The growth is slow and the tree does not stand severe cold well. Timber pale to brown with darker prominent rings, resinous, moderately hard, works well, moderately durable, a wood of medium quality. A cubic foot weighs 33 lb. dry and 48 lb. to 56 lb. green.

Fig. 36. *Pinus sylvestris.*
Ripe but opened female cone, and needles of a single dwarf shoot (both nearly natural size).

Fig. 37. *Pinus Pinea.*
Ripe but unopened female cone, and needle leaves of a single dwarf shoot (about one-half natural size).

P. Laricio (*P. austriaca*). Corsican Pine (Black Pine). A native of South Europe. Needles 4 inches to 6 inches long, dark-green. Cones up to 8 cm. long and almost terminal. Seeds broadly winged. Grows best above 1,000 feet elevations in Victoria and may exceed 100 feet in height. Wood pale but darker at the centre, resinous and coarse grained, but fairly strong and durable. The tree yields resin freely. The variety *austriaca* (*nigricans*) has straighter and less glabrous needles. It is an inland or mountain form of *P. Laricio*.

There are four other geographical forms and six horticultural varieties of this variable species.

P. Pinaster (from the star like cluster of cones) (*P. maritima*). Maritime Pine (Cluster Pine).

This and the following species are distinguished from *P. Laricio* by the cones being lateral instead of nearly terminal. Needles 8 inches to 12 inches long. It attains 40 feet to 60 feet in height and will grow on sandy coastal soils. Timber pale to brown with prominent darken resinous annual rings. Moderately hard. Grain smooth, even, works well, but is of medium quality only and not very durable. It yields turpentine and resin. An old tree will yield up to 16 lb. of crude turpentine containing 4 lb. of resin. The tree yields turpentine from its twentieth to its one hundred and twentieth year. It is grown in South France and is native to the western shores of the Mediterranean. It forms a good coastal wind break, but the stem is nearly always curved and hence not good for timber. The best trees appear to grow in Corsica.

Fig. 38. *Pinus Laricio.*
Open female cone (about natural size).

P. halepensis. Aleppo Pine. Native to the Eastern Mediterranean. Habit, timber and general characters similar to the preceding, but it may attain a height of 80 feet and the old wood is darker. It is possibly only a variety of *P. Pinaster* with shorter and more slender needles (3 inches to 5 inches) instead of longer and more stiff and rigid. Cones 6 cm. to 8 cm. long. It grows well near the sea and forms a good coastal wind break.

Fig. 39. *Pinus Pinaster.*
Ripe but unopened female cone, and needle leaves of a single dwarf shoot (about two-thirds natural size).

P. mitis. (*P. echinata*) Yellow Pine. A native of North America. It grows in poor sandy, rocky or clayey soils, and attains 80 feet to 90 feet in height. Needles 2 inches to 3 inches long, dull, dark-green. Timber yellow, somewhat resinous, moderately hard and durable, but useful for floors, planking, furniture and general building purposes.

P. muricata. Prickle Pine. A tree 30 feet to 60 feet high, 1 foot to 3 feet diameter, and 150 to 200 years duration. It averages 1 foot diameter in 60 to 70 years. Needles 8 cm. to 15 cm. long, deep yellow-green, densely clustered at the end of the branches. Cone scales with curved

prickles, cones persistent but not becoming imbedded in the wood. Wood pale yellowish-brown, coarse, hard, and heavy. A native of California, growing in heathy swamps and also in dry barren soils with a rainfall of 11 inches to 20 inches and a temperature range of 25° to 100° F. A useful cover tree for poor soils and areas where other trees will not grow.

Fig. 40. *Pinus mitis.*
Opening female cone, and needle leaves of a single dwarf shoot (about natural size).

P. contorta. Scrub Pine or Lodge Pole Pine. A native of North America. Usually a small tree 20 feet to 30 feet high, but attains up to 100 feet in height, with a diameter of 1 foot to 3 feet and an age of 100 to 200 years in the Rocky Mountains, and there yields a pale reddish to yellowish-brown straight grained, light and valuable timber. It also forms low thickets along the coast. Leaves 3 cm. to 5 cm. long, cones about 3 cm. to 4 cm. long, persisting for several years. It seeds early from the eighth to tenth year onwards. It is easily killed by bush fires owing to its thin bark, and is hence unsuited for Victorian conditions.

P. resinosa. Red Pine. A native of North America, from Newfoundland to Manitoba and Minnesota. A tree from 70 feet to over 100 feet high, with a rather hard, reddish-brown, and dense, strong timber, fairly durable, and with pronounced rings. It is useful for constructional work, but is rarely obtainable in longer beams than 10 feet to 16 feet. A cubic foot weighs 44 lb. to 50 lb. Also yields turpentine. Bark smooth and reddish. Leaves 5 inches to 6 inches long, dark-green, in bunches at the ends of the branchlets. The roots and knots are very resinous and can be used as torches.

Fig. 41. *Pinus resinosa.*
Opening female cone (nearly natural size).

P. densiflora (from the dense spike of male cones). Japanese Red Pine. A native of China and Japan. It attains a height of 100 feet and an age of 200 years or more. Wood resinous, fairly strong and durable, and similar to the preceding. It is softer and lighter than Baltic Pine, but is rarely free from knots. It makes good sounding boards for violins and is much valued in Japan where it is used for

building. A cubic foot weighs 24 lb. Needles 7 cm. to 10 cm. long, cones about 5 cm. long with rather thin scales. A variety with rather longer and brighter green needles and even smaller cones, sometimes known as *P. Massoniana*, also grows in Japan.

C. *Taeda sub-section* (includes about fifteen species). Dwarf shoots usually with three needles, the needle hence is triangular, usually long, and the cones mostly large. The wood is usually resinous and durable.

Fig. 42. *Pinus densiflora.*
Open female cone, and needles of a single dwarf shoot (slightly reduced in size).

Fig. 43. *Pinus Coulteri.*
Ripe but opened female cone (about one-fourth natural size).

P. Coulteri. (*P. macrocarpa*). Coulter Pine. California. Cones very large and heavy (4 lb. to 5 lb.) up to 30 cm. or 40 cm. long, the cone scales with rigid upwardly curved tips often resinous. Needles 15 cm. to 30 cm. long. A tree of fairly quick growth reaching 40 feet to 80 feet in height with a diameter of 2 feet to 3 feet at 100 to 150 years. Wood rather brittle, reddish brown, soft and light, not of great value. In cold climates its growth is very slow.

P. rigida. Stiff Pine (Pitch Pine). North America, from New Brunswick to Ontario and Kentucky, chiefly in the Pine Barrens of Eastern U.S.A. A tree up to 80 feet in height with horizontal branches, and stiff spreading needle leaves usually in threes, and 5 cm. to 12 cm. long. Cones ovate, nearly sessile, often in clusters. Cone scales with a triangular umbo, bearing a slender recurved prickle. The tree is hardy and grows on poor or dry soils. Its early growth is rapid, and the stumps will often sprout again. Wood resinous with prominent annual rings. Strong and durable. A cubic foot averages 45 lb. Useful for planks, beams, flooring, and general purposes.

P. Sabiniana. Digger Pine. California. Similar to *P. Coulteri*, but the cones shorter and thicker. Needles rather sparse, slender and flexible, or pendulous, 20 cm. to 30 cm. long. Rarely exceeds 50 feet in height, 1 foot to 2 feet diameter, and 50 to 100 years age. Cones 18 cm. to 25 cm. long, cone scales resinous and with a sharp bent point. Wood yellowish-brown, tough and coarse grained, but the tree usually grows in rough or stony localities, with a crooked stem and twisted grain. Seeds large and edible. It resists drought and dry summer heat, and is worthy of trial in Mallee districts as a cover and shelter tree.

Fig. 44. *Pinus Sabiniana.*
Open female cone (about one-fourth natural size).

P. tuberculata is a small mountain tree of California of no value for timber but having its cones borne in rings on the main stems or larger branches, and persisting until they are partially imbedded in the wood.

P. Taeda. Loblolly Pine (Incense Pine). Forms large forests in Florida and North Carolina. Fifty to 80 feet high, and usually in barren sandy localities. Cones 8 cm. to 10 cm. long, often covered with resin. Yields turpentine. Needles light-green, and slender but stiff, 15 cm. to 22 cm. long. Cones sessile, 7 cm. to 13 cm. long. It may exceed 100 feet in height. Neither this nor either of the first two species stands cold well, and the timber is only of medium quality.

Fig. 45. *Pinus ponderosa.*
Open female cone, seeds and needle leaves (about two-thirds natural size).

P. ponderosa. Western Yellow Pine. Mexico to the Rocky Mountains and British Columbia. A tree often exceeding 150 feet in height, with a diameter of 3 feet to 5 feet, rarely more, and an age of 300 to 500 years. Needles 10 cm. to 27 cm. long. Cones almost sessile, 8 cm. to 15 cm. long. Cone scales with a short point or umbo. Old bark yellowish-brown, and in smooth plates 4 inches to 8 inches broad. Young trees with a dark furrowed bark. It stands cold fairly well, but in Victoria it is usually somewhat slow in growth. Timber valuable, reddish-brown, with paler yellow rings and darker autumn wood, but sometimes paler and less resinous than usual. It is strong, heavy, and durable. Moderately hard. A cubic foot weighs 44 lb to 50 lb. when seasoned. Useful for beams, planks, flooring, furniture, and building construction.

P. palustris. Long-leaf Pine. (This name is sometimes applied to the Chir Pine, *P. longifolia*). Virginia to Florida. A tree exceeding 100 feet in height. Needles 20 cm. to 40 cm. long. Cones almost sessile, 15 cm. to 25 cm. long. Wood durable, yellow to brown, sap-wood paler but small in amount. A cubic foot weighs 44 lb. to 47 lb. when air dry. An important source of timber for general purposes (Yellow Pine), as well as of turpentine (usually yielding about 20 lb. a year until exhausted), and of resin. The wood is often placed on the market as Pitch Pine, which name is also applied to *P. rigida.* The tree is somewhat slow in growth.

P. Jeffreyi. Jeffrey Pine. Oregon to North California. This is closely related to *P. ponderosa*, and is possibly only a variety with glaucous branches, needles a greyish-green instead of a purer green, and larger cones, 15 cm. to 25 cm. long. It has edible seeds, will stand cold, but not drought, and yields a rather coarse light-straw coloured timber. The needles average 20 cm. in length and are rigid and spreading. Cone scales with a projecting point or umbo.

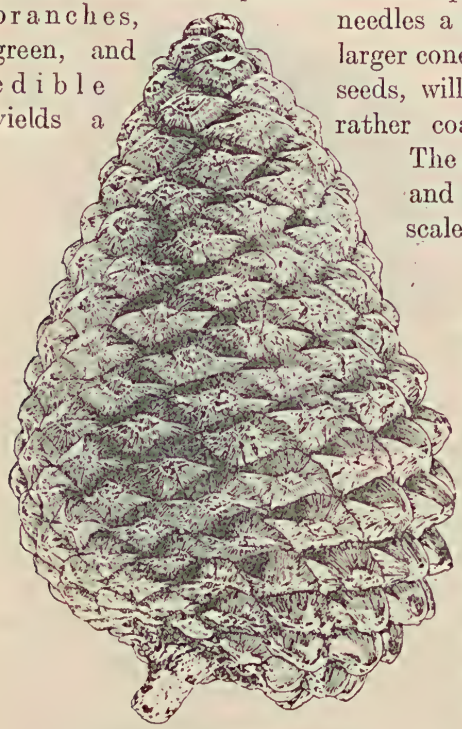

Fig. 46. *Pinus radiata.*

Ripe but unopened female cone (nearly half natural size).

P. radiata (*P. insignis*). Insignis Pine (Monterey Pine). California. Attains 80 feet to 100 feet height, 3 feet to 5 feet diameter and 100 to 150 years. Average early diameter growth 1 foot to 1¼ feet per 20 years. Of rapid growth (up to 5 feet per annum). It will grow near the coast but grows best at elevations of 1,000 feet or so or in moist valleys. Does not stand severe frost. Needles slender, 4 inches to 6 inches long, mostly in threes, but odd clusters in twos, or regularly in twos in the variety *pinnata.* Cones 4

inches to 6 inches long, obtuse at the base, pointed at the tip, usually more developed on the exposed side. Seeds black with a pimpled surface. The timber is pale, coarse-grained, and of medium quality. Not abundant in California, and is not used commercially to any extent in U.S.A. In Victoria it grows well on upland rises and is largely planted. It is easily raised and transplants well.

P. canariensis. Canary Pine. It forms large forests in the Canary Islands at elevations of 1,500 to 2,000 feet, and attains a height of 80 feet. The cones are up to 18 cm. long, and the needles pendulous, light-green, and 20 cm. to 30 cm. long. The timber is dense, durable, and resinous. The tree suffers during hot dry summers, shedding a large proportion of its needles, and the timber production is slow in Victoria. It grows better on elevated hill sides than on the plains. The wood is reddish, resinous, and durable.

Fig. 47.*Pinus canariensis.*
Ripe but unopened female cone (about half natural size).

Pinus longifolia. Chir Pine. It is an important forest tree of Thibet and the Himalayas, and has needles 25 cm. to 40 cm. long, thin, flaccid, pendulous, and light-green. Cones 10 cm. to 15 cm. long. Height may exceed 100 feet in 60 to 70 years, or 40 feet in 20 to 25 years. It stands moderate cold better than dry heat. The growth in Victoria is only moderately rapid. It is a valuable timber tree in the Himalayas. The wood is like that of *Pinus Strobus*, but is a little harder and with the resinous layers more prominent. It has prominent annual rings and faint medullary rays. A cubic foot weighs 40 lb. to 43 lb. when air-dry. The crushing strength is 5 to 7½ tons per square inch. It is a valuable high class soft wood for general purposes.

D. *Pseudo-strobus sub-section.*—About ten species from North America to Mexico. All have the needle leaves usually in fives.

P. Montezumae. Montezuma Pine is the most important species, and forms large forests in the mountains of Mexico. It grows to a height of 80 feet to 100 feet. The cones and needles both average 20 cm. to 30 cm. long. The wood is pale, soft, and resinous. Associated with and closely related to it are *P. Hartwegii* and *P. Pseudo-strobus* (Mexico) which differ in having smaller cones 10 cm. to 15 cm. long.

P. Torreyana (Lower California) is also related, but rarely exceeds 35 feet, and is often a dwarf coastal tree with rigid dark-green needles 20 cm. to 30 cm. long, and cones 10 cm. to 15 cm. long. It has little timber value and does not stand severe cold, and its duration is 100 to 150 years. Wood pale, reddish-brown, soft, and brittle.

KEY TO THE MORE COMMON TIMBER PINES IN THE ABSENCE OF CONES.

Needles usually in fives, rarely fewer 1
Needles in twos, threes or single 4
Needles mostly in fours, but often in threes and fives on same tree *P. quadrifolia.*

1. Each needle with a single vascular bundle 2
   Each needle with two vascular bundles .. .. *P. Torreyana.*

2. Needles under 1½ inches .. .. *P. parviflora.*
   Needles over 1½ inches 3

3. Branchlets glabrous .. .. *P. Strobus.*
   Branchlets brownish tomentose .. .. .. *P. Cembra.*
   Branchlets pubescent, needles with fine white lines on back *P. Lambertiana.*

4. Needles usually single .. .. .. *P. monophylla.*
   Needles always more than one together 5

5. Needles usually three or four, rarely fewer 6
   Needles regularly two 12

6. Branchlets glaucous, leaves with a bluish or greyish tinge .. 7
   Branchlets more or less hairy or not glaucous, leaves not bluish or greyish-green, but dark or grass-green 9

7. Needles slender drooping .. .. *P. Sabiniana.*
   Needles stiff and rigid 8

8. Buds very resinous, needles dark .. .. .. *P. Coulteri.*
   Buds not very resinous, needles pale green .. .. *P. Jeffreyi.*

9. Needles slender, drooping 10
   Needles slender, twisted 4 inches to 6 inches long, but hardly drooping .. .. *P. radiata.*
   Needles stiff and rigid 11

10. Leaves all over 30 cm. long, light green .. .. *P. longifolia.*
    Leaves all under 30 cm. long, light green .. .. *P. canariensis.*
    Leaves mostly under 30 cm. long, dark green .. .. *P. australis.*

11. Needles pale or bluish green .. .. .. *P. Taeda.*
    Needles dark or yellowish green .. .. .. *P. ponderosa.*

12. Branchlets glaucous 13
    Branchlets not glaucous 14

13. Needles dark green .. .. *P. mitis.*
    Needles bright green .. .. *P. densiflora.*

14. Needles 2 cm. to 9 cm. long 15
    Needles 8 cm. to 20 cm. long 17

15. Branchlets brown to orange .. .. .. *P. contorta.*
    Branchlets greenish yellow to brown 19

16. Needles slender, buds not resinous .. .. .. *P. halepensis.*
Needles stout, buds resinous .. .. .. *P. sylvestris.*

17. Trees rarely much exceeding 30 feet in height .. *P. muricata.*
Trees usually exceeding 40 feet in height when adult 18

18. Buds oblong, scales reflexed.. 19
Buds pointed, the scale tips not reflexed 20

19. Needles usually twisted .. .. *P. Pinaster.*
Needles straight or slightly twisted .. .. .. *P. Pinea.*

20. Needles stiff .. .. *P. Laricio.*
Needles slender and flexible .. .. .. *P. resinosa.*

CEDRUS.

The Cedar. A genus of three species with somewhat four-sided clustered leaves, erect rounded cones, flat at top and bottom, ripening in two to three years, when the broad flat closely appressed scales separate. The name "Cedar" is now used for the wood of at least 30 widely different trees, some of which (*Cedrela*, &c.) do not even belong to the *Coniferae*.

C. Libani. Cedar of Lebanon. Native of Asia Minor and Cyprus. A tree 100 feet to 130 feet high, attaining an age of 2,000 to 3,000 years. It has a massive trunk, widely spreading, more or less horizontal, compact branches and a bluntly conical crown up to 80 feet in height. Cones 7 inches to 12 inches long, and 5 cm. to 6 cm. broad. Needles 2 cm. to 3 cm. long. Wood, red, rather soft, but durable, works well, and a very valuable timber when available. The sap-wood of young trees is pale and very inferior. The growth is slow, and the rings very close together.

C. Deodara. Himalayan Cedar. (Himalayas at 6,000 feet to 12,000 feet.) It is a more slender tree with the apical branches always drooping at first and straightening as they grow older. It attains a height of 150 feet to 200 feet, and tapers much at the top. It has rather longer needles, and is of somewhat more rapid growth than *C. Libani.* It grows best on hill sides, but will grow in a variety of soils and situations. It suffers from smoke in towns and from dry heat in summer, but stands

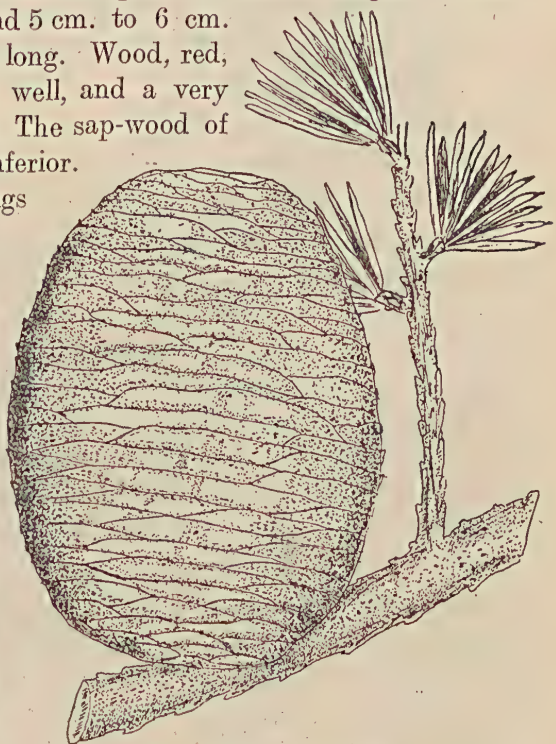

Fig. 48. *Cedrus Deodara.*
Ripe female cone and three tufts of needle leaves (about one-half natural size).

severe cold. Timber yellowish, close-grained, and resinous, but without true resin pores, strong, very durable. The sap-wood is perishable. A cubic foot weighs 36 lb. to 38 lb. It is useful for furniture, sleepers, panelling, oars, bars, and generally wherever strength and lightness are required. Rather slow in growth, in Victoria rarely exceeding 1 foot to 2 feet a year.

C. atlantica has a more compact habit, ascending branches, stiffer needles, smaller and more cylindrical cones. The wood, as in the foregoing, is a valuable timber when available, but all three trees are grown more for decoration than for timber. It reaches a height of 80 feet to 100 feet, and is native to the Atlas Mountains at elevations of over 5,000 feet. It is quite hardy and slightly more rapid in growth than *C. Deodara*.

LARIX.

The Larch. A genus of eight species, all with deciduous needles and the branches scattered instead of in whorls. The female cone scales are usually bright-purple or red, and are looser, more pointed, and not so broad and flat as in *Cedrus*, and the cones ripen in one year, instead of in two to three as in *Cedrus*, and shed their seed in autumn. The tips of the basal bract scales can usually be seen between the fruiting placental scales even when the latter are larger.

	Young shoots covered by a white wool	*Larix lyalli.*
	Young shoots not covered by a white wool	1
1.	Bracts longer than the placental scales	*L. occidentalis.*
	Bracts not longer than the placental scales at least at the middle of the cone	2
2.	Cones 1 cm. to 2 cm. long	*L. americana.*
	Cones 2 cm. to 3 cm. long	*L. europaea.*
	Cones over 3 cm. long	*L. sibirica.*

L. occidentalis. Western Larch. It reaches a height of 100 feet to 200 feet with a diameter of 3 feet to 5 feet and an age of 300 to 700 years. On the average it takes 100 years to increase a foot in diameter and it may reach 6 inches in diameter in the first 30 to 35 years. The pale yellowish green leaves turn bright yellow in autumn and average 1 inch to 1½ inches in length. The wood is reddish-brown with a thin layer of pale sap-wood. It is strong, durable and a valuable timber when obtainable. A cubic foot weighs 46 lb. to 48 lb. It only grows well in moist well drained soils and in mixed stands is easily suppressed by pines.

L. lyalli. The Alpine Larch. Oregon to Washington. This usually grows near the upper timber line and, although it may reach 30 feet to 50 feet with a diameter of 1 foot to 2 feet and an age of 400 to 500 years, it is often quite stunted. It is hardy to exposure, cold and poor soils, but is of more importance as an alpine cover tree than for timber. The wood is reddish-brown, tough and durable. A cubic foot weighs 43 lb. to 45 lb.

L. europaea (*L. decidua*). The Larch. Native to Europe at elevations of 2,000 feet to 5,000 feet. Often grown in parks and gardens Attains 50 feet to 90 feet. The foliage is a pale green and the branches are horizontal with drooping tips. Needles on the dwarf shoots in clusters of 30 to 40, about 2 cm. long ; solitary and longer on the ordinary shoots,

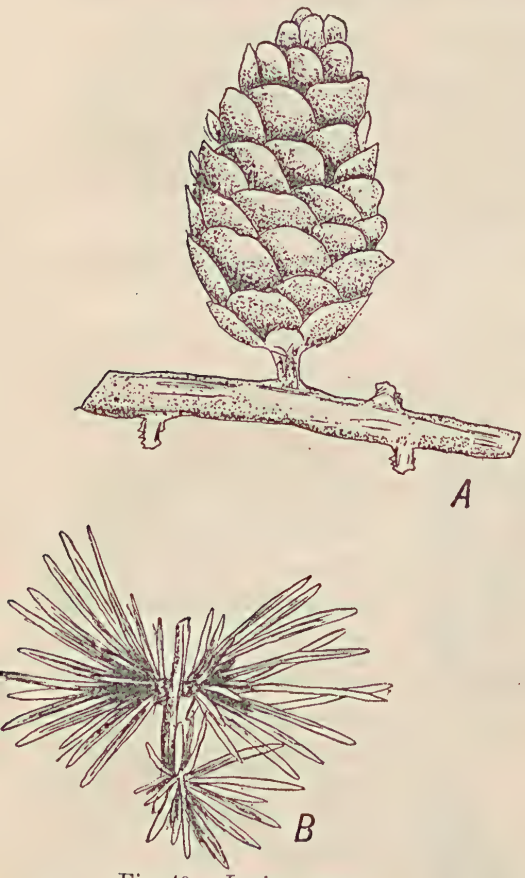

Fig. 49. *Larix europaea.*
Ripe female cone and three tufts of needle leaves (about natural size).

Fig. 50. *Larix americana.*
Open female cones, two clusters of dwarf shoot needles, and above and below them a cluster of stem needles (natural size).

cones $\frac{3}{4}$ inch to $1\frac{1}{2}$ inches long. The tree is usually mature for timber at 40 years, when it should be 1 foot to 2 feet in diameter. It should grow $1\frac{1}{2}$ feet to 2 feet in height a year. It is very liable to Larch rot which destroys the heart-wood. The wood is reddish-brown with a pale yellow sap-wood. The annual rings vary from $\frac{1}{3}$ to $\frac{3}{4}$ of an inch in width. The autumn wood is darker. It contains a little resinous material expelled by heat, mainly from the darker resinous autumn wood of the annual rings. The resin obtained by boring the tree yields venetian turpentine. The timber is very durable and fairly strong and compact, but soft like deal and works well. It is valuable for furniture, building and boat-construction, for sleepers, bed frames, panelling and flooring, poles, pails and boxes. A cubic foot weighs 28 lb. dry and 40 lb. to 48 lb. green. In Victoria its growth appears to be slow, and it will only succeed in mountainous districts with a high rainfall.

L. americana (*L. pendula*, *L. Laricina*). The Black Larch or Tamarack, is a native of North America. It has shorter needles and cones only 1 cm. to 1½ cm. long, the bract scales shorter than the placental scales except at the base of the cone. It attains 70 feet to 90 feet in height, but a common maximum height is 40 feet to 50 feet with a diameter of 12 inches to 16 inches and an age of 80 to 150 years. The timber is like that of ordinary Larch, but is light brown or light orange-brown with a pale or white sap-wood. It is quite as durable and even stronger, tougher and harder, but the growth is very slow. A cubic foot weighs 35 lb. to 40 lb. When large enough it is used for sawmill timber, and also for poles and sleepers. It grows best on deep moist well drained soils, but can also grow in saturated soils or even swamps.

L. siberica (North East Russia and Siberia) has longer needles than *L. europaea*.

PSEUDO-LARIX.

This genus of one species is native to North China, and is distinguished from Larix by its deciduous female cone scales.

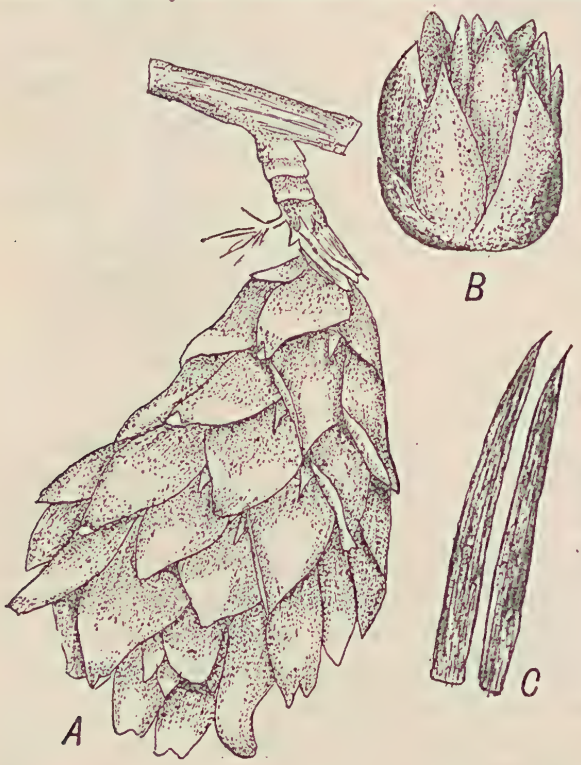

Fig. 51. *Pseudolarix Kaempferi.*
A. Ripe and B, young female cone. C. Needle leaves (nearly natural size).

P. Kaempferi (*Larix japonica*, *L. leptolepis*). Golden Larch. A tree 90 feet to 100 feet high of more rapid growth than either the Larch or Tamarack. The needles are flatter than *L. europaea*, 4 cm. to 7 cm. long and turn golden yellow before falling in autumn. It is often grown in parks. The wood is rather hard and very durable. Cones pendulous about 7 cm. to 8 cm. long with deciduous scales, each with two winged seeds.

PICEA.

Spruce. The cones are usually pendent, elongated ovoid, and fall as a whole after shedding the seeds, the cones ripening in one year. Occasionally the cones persist after shedding the seed. The bract scales are very small or inconspicuous, the placental scales large, but thin and without prickles, each with two winged seeds. Needles single, spreading, quadrangular, with usually stomata on all

four sides, and often with one or two resin canals close to the lower side. Rarely the leaves are flattened with the dorsal and ventral angles very obtuse.

A genus of fourteen species, some closely similar, found in the temperate regions of Europe, Asia and North America.

KEY TO COMMONER SPECIES OF PICEA.

Leaves flattened with pale interstomatal striae on the upper surface .. .. *P. sitchensis.*

Leaves quadrangular with stomata on all four sides 1

1. Cone scales oblong, loose, often striate or wavy 2
   Cone scales rounded, closely appressed before the cone ripens .. 3
2. Leaves with two resin canals. Leaves sharp pointed and stiff .. *P. pungens.*
   Leaves without two resin canals. Leaves less sharp pointed and stiff *P. Engelmanni.*
3. Fruiting cones 2 inches long or less 4
   Fruiting cones over 2 inches long 5
4. Young shoots hairy. Cones persisting for several years *P. Mariana.*
   Young shoots not hairy. Cones usually falling after the first year *P. canadensis.*
5. Leaves spreading, very rigid, sharply pointed .. .. *P. polita.*
   Leaves not very rigid and slanting forwards 6
6. Leaves under $\frac{1}{2}$ inch long .. .. *P. orientalis.*
   Leaves over $\frac{1}{2}$ inch long 7
7. Cones exceeding 8 cm. long, scales with a denticulate margin *P. excelsa.*
   Cones less than 8 cm. long, scales with an entire margin *P. obovata.*

P. excelsa. Common Spruce. Native to Europe. Often attains 100 feet to 150 feet height, sometimes 6 feet diameter and 500 to 600 years age. It has a pyramidal crown with a pointed top. Needles 1 cm. to 2 cm. long. Cones elongated, 10 cm. to 16 cm. long. Timber white to brownish, sap and heart-wood similar, with well marked annual rings. A fairly soft, easily worked timber, but apt to contain small hard knots, which are dark or surrounded by a dark ring. The wood is white, moderately strong and tough, light and elastic, with an even straight grain, but it is not very durable when exposed to the weather. Used for poles, spars, cases, match boards, kitchen tables and cupboards, paper pulp, &c. A cubic foot weighs 35 lb. to 38 lb. It forms a good wind break but after 30 or 40 years often develops a ragged, irregular top. It grows best on moist soils. The early growth is slow, but in a few years it will increase 2 feet to 3 feet in height a year. It is adult

about the fiftieth year. The Himalayan Spruce (*P. Morinda*) has a similar but lighter timber. A cubic foot weighs 30 lb. to 33 lb. It will probably be an important source of spruce timber in the future.

P. canadensis (*P. alba*). The White Spruce of North-East America and Canada. This is a smaller tree (usually 50 feet to 80 feet) with greyish or bluish green needles hardly exceeding 1 cm. long, and cones 3 cm. to 4 cm. long. In the far north it becomes dwarfed. It may last 250 to 300 years, then being 80 feet to 100 feet high and 2 feet to 4 feet diameter. The leaves have two lateral resin canals and when young emit a foetid odor when bruised. The wood is

Fig. 52. *Picea excelsa.*
Ripe female cone and foliage leaves (about two-thirds natural size).

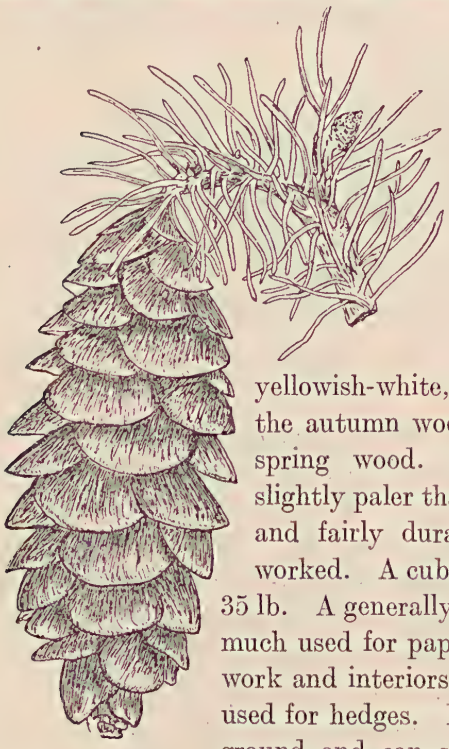

Fig. 53.
Picea canadensis.
Open female cone, foliage leaves and a bud (nearly twice natural size).

yellowish-white, with well marked narrow rings; the autumn wood is very much harder than the spring wood. The sap-wood is a thin layer slightly paler than the heart-wood. Tough, strong and fairly durable, moderately soft and easily worked. A cubic foot weighs 25 lb. or when fresh 35 lb. A generally useful but not high grade timber, much used for paper pulp, but also for construction work and interiors. It also yields resin, and can be used for hedges. It prefers damp but well-drained ground and can stand severe cold, but not severe dry heat. It is tolerant of shade and averages 1 foot to 1½ feet a year, and is often a short-lived tree, becoming adult in 30 to 50 years, but may last for 200 to 300 years.

P. sitchensis (*Pinus Menziesii*). Sitka Spruce. A native of the Western United States and Canada. It often exceeds 100 feet and reaches an age of 400 to 800 years with a diameter of 4 feet to 6 feet. Cones

5 cm. to 8 cm. long with projecting tongue-like scales. Needles white streaked above, 1 cm. to 2 cm. long. It has a brown heart-wood and yellowish-white sap-wood and is moderately soft but close grained and remarkably free from knots. A cubic foot weighs 26 lb. when quite dry. It is fairly durable and elastic and for its weight one of the strongest timbers known. Used for doors, windows, oars, staves, building construction, aeroplanes, &c. The tree stands cold well but not dry heat.

Fig. 54. *Picea sitchensis.* Female cone and leaves (about natural size).

P. Mariana (*P. nigra*). Black Spruce (from its dark ashy brown bark and dark bluish green foliage), Canada, &c. It has cones 1 cm. to 1½ cm. long, and is rarely more than 30 feet to 50 feet high and 1 foot to 3 feet diameter. In the far north (Alaska) it is dwarfed to 12 feet to 15 feet. The leaf has two lateral resin canals. The wood is pale, and is used for rulers as well as furniture and building. It is light, strong and elastic, but not very durable. It is light yellow, with very narrow annual rings. A cubic foot weighs 30 lb. to 33 lb. Spruce beer is made from the young shoots and the wood is used for paper pulp. It grows on rocky mountain sides up to 3,500 feet, and also in swamps or wet alluvial soils. The growth is very slow. It may last 200 years and then be only 1 foot to 2 feet in diameter and in unfavorable situations may only be 2 inches to 3 inches diameter after 50 years. It stands cold but not dry heat and stands shade better than exposure.

P. obovata (North-East Europe and Asia). This has cones 5 cm. to 8 cm. long and needles 1 cm. to 2 cm. long. It grows to 100 feet in height. Wood soft, pale, useful for packing cases and cheap furniture, &c.

P. orientalis (Asia Minor and Caucasus). Eastern Spruce, has cones about 6 cm. to 8 cm. long, but has shorter needles than the preceding, and they are more appressed to the branches. It reaches 80 feet to 100 feet in height. The timber of this and the preceding species is about equal in value to common spruce, being tough and fairly durable.

Fig. 55. *Picea Mariana.* Female cones from above and from side (nearly twice natural size).

Picea pungens (*P. Parryana*) (Wyoming to Colorado). The Colorado Blue Spruce is a tree up to 100 feet in height, but usually smaller with variously coloured foliage. The growth is slow, trees 300 to 400 years

old usually not exceeding 2 feet in diameter. The leaves average an inch in length and have usually only one resin canal. Cones 2 inches to 4 inches long. Wood pale yellow, sap-wood nearly white, rather soft and brittle with narrow rings. It is little used. A cubic foot weighs 23 lb.

P. Engelmanni (Alberta to Arizona) is somewhat similar in appearance to White Spruce, but has shorter cones, 2 inches to 2½ inches long, and leaves without resin canals. They have a fœtid odour like that of the leaves of *P. alba* when bruised. The tree reaches 80 feet to 100 feet in height and 350 to 600 years age with a diameter of 2 feet to 3 feet. At high elevations, of over 6,000 feet, it is stunted and may require 200 years to reach 5 inches diameter. It has pale, soft, non-resinous timber. A cubic foot weighs 20 lb. to 22 lb. when air dry (15% of moisture). It is used for poles and in construction but is not a high grade timber.

P. polita (Japan) has stout branches with rigid spreading spiny leaves. It resists frost. Cones 10 cm. to 15 cm. long, cone scales minutely notched. Height 80 feet. The last three species are more horticultural than timber trees.

TSUGA.

A genus of six species in Asia and North America. It has rather the habit and female cones of *Picea*, but has the leaves flat, linear, contracted to a short thin stalk, and usually arranged more or less in two lateral rows. The branches are scattered instead of in regular whorls. The cones mature in one season. The seeds have usually minute resin cells in the outer surface.

KEY TO COMMONER SPECIES OF TSUGA.

Cones mostly 6 cm. to 8 cm. long. Bracts exposed *T. Douglasii.*

Cones 9 cm. to 15 cm. long. Bracts exposed .. *T. macrocarpa.*

Cones under 6 cm. long. Bracts short and more or less hidden in the cone 1

1. Cones 5 cm. long .. .. *T. Pattoniana.*
   Cones under 5 cm. long 2
2. Cones about 1½ cm. long .. .. *T. canadensis.*
   Cones over 1½ cm. long 3
3. Tree not exceeding 30 feet .. .. *T. Sieboldi.*
   Tree exceeding 30 feet 4
4. Leaves with two white lines beneath. Cones and cone scales oblong *T. caroliniana.*

   Leaves without two white lines, but with a median groove on the upper side. Cones oblong, cone scales contracted above the middle .. .. *T. heterophylla.*

   Leaves without two white lines beneath. Cones more rounded *T. dumosa.*

T. Douglasii (*Pseudo-tsuga Douglasii, Pseudo-tsuga taxifolia*). Douglas Fir or Oregon. Extends from West Canada and Washington to Mexico, forming large forests in the Rocky Mountains. It attains 300 feet height and 9 feet to 10 feet diameter and an age of 700 years. It averages 2 feet in diameter per 100 years. In the fruiting cones the tri-radiate tips of the bract scales project between the placental scales as in *Abies*. Cones 6 cm. to 10 cm. long. The seeds have no superficial resin vesicles. Needles 2 cm. to 2½ cm. long, flat and slightly grooved above. The timber is brown with a yellowish sap-wood, annual rings prominent, the autumn wood darker and a resinous brown. A moderately soft but strong timber and durable under cover but not in the ground. Useful for beams, flooring, and generally for building construction. A cubic foot weighs 30 lb. to 38 lb. when seasoned. The wood does not resist fire and the growing tree suffers during hot dry winds. It grows best in rich, deep moist mountain soil, and is then of rapid growth when young, growing 2 feet to 2½ feet a year. This species was formerly placed in a separate genus *Pseudo-tsuga* on account of the bract scales being as long as or longer than the placental scales. This variation in relative length is, however, not more pronounced in the species of *Tsuga* than it is in different species of *Abies*, which are grouped in the one genus.

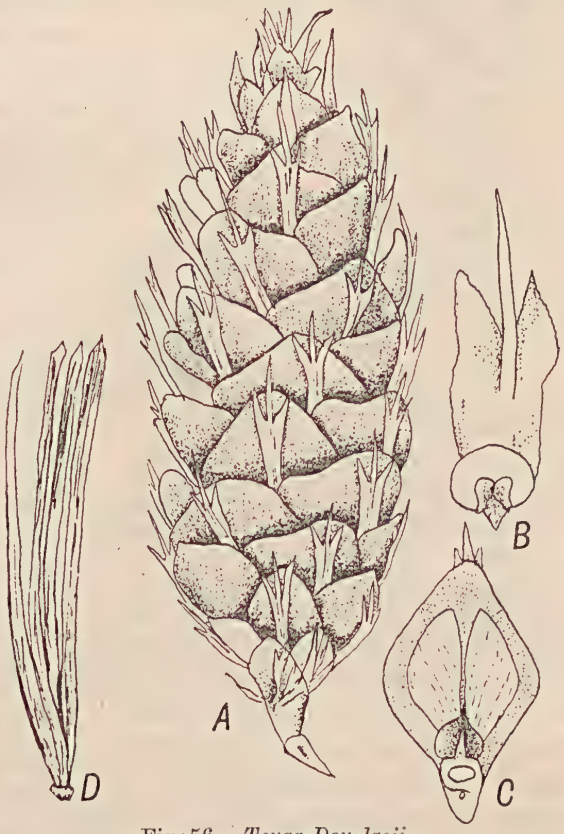

Fig. 56. *Tsuga Douglasii.*

A. Ripe female cone showing trifid bract scales.
B. One of the basal scales of the cone, the bract scale overtopping the small placental scale with its two rudimentary ovules.
C. A median scale of the cone from above, the placental scale with its two winged ovules covering the bract scale.
D. A cluster of needle leaves.

T. macrocarpa, Bigcone Spruce, is a smaller and shorter lived tree with a less used timber, reddish-brown, fine grained, tough and hard. It forms useful cover on dry mountain slopes. The seeds are large and chocolate brown. It is native to California.

T. canadensis. The Canadian Hemlock Spruce, has a similar distribution but has the bract scales shorter than the placental scales, small almost terminal cones of a few rounded scales, the cone 1½ cm. long and the needles about 1 cm. long. It attains a height of 60 feet to 100 feet, is at first pyramidal but after 30 to 40 years develops a rounded top, and yields a useful timber (frames, weatherboards, joists, rafters, boxes, crates, &c.) as well as pitch and tannin (bark). The wood is soft, not very strong, brittle and apt to splinter. The heart-wood is light brown, or paler, or tinged with red. Although a low grade timber it has come much into use. A cubic foot weighs 36 lb. Related closely to *T. canadensis* are the following three species.

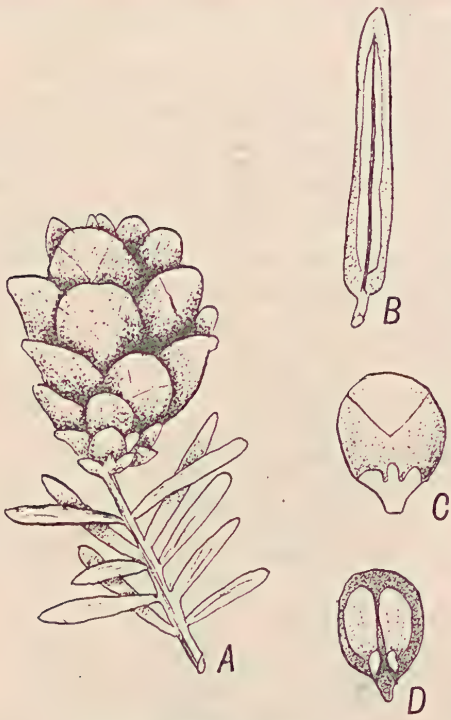

Fig. 57. *Tsuga canadensis.*
A. Leaves and open female cone.
B. Leaf from above.
C. Cone scale from below, and D, from above, showing the two winged seeds.
(A, C and D about twice and B about three times natural size.)

T. Pattoniana (*T. Hookeriana*, *T. Mertensiana*). (California to British Columbia). The Black Hemlock has the habit of a *Deodar* and attains a maximum height of 100 feet to 150 feet with a diameter of 3 feet to 4 feet and an age of 500 years. In exposed situations it may be only a few feet high. The oblong cones are 5 cm. to 7 cm. long and have numerous scales. The cones are very abundant and usually pendulous. The leaves are usually between 1 cm. and 2½ cm. long and are more cylindrical than flat, and bunch together towards the upper surface. Wood soft and pale reddish-brown. It is not durable and is little used. A cubic foot weighs 27 lb. to 28 lb. The tree prefers sheltered localities and deep moist soils, ; it dislikes dry hot winds.

T. dumosa (Himalayas up to 9,000 feet) is a tree of compact habit and 60 feet to 80 feet high with cones 3 cm. long.

T. heterophylla. The Western Hemlock of U.S.A. It may reach 100 feet to 200 feet in height with a diameter of 2 feet to 5 feet or more and an age of 200 to 500 years. It averages a foot diameter per 100 years. The wood is pale yellowish-brown. It is a soft but useful timber. A cubic foot weighs 32 lb. to 33 lb. The bark is rich in tannin. It requires moist surroundings for good growth.

T. Sieboldi (North Japan) is a small tree 20 feet to 30 feet high with cones 3 cm. long. Its wood is much used for carving in Japan.

T. caroliniana. The Carolina Hemlock Spruce reaches 50 feet to 70 feet and has dark green leaves, 1 cm. to 2 cm. long with two white lines beneath and cones 2 cm. to 4 cm. long. It is a handsome garden tree.

BOTANIC & DOMAIN GARDENS

ABIES.

Fir or Balsam Fir. A genus of 20 species in Europe, Asia and North America, with the habit of *Picea*, the leaves of *Tsuga* and the projecting bract scales of *T. Douglasii*, but the cones erect and the cone scales deciduous, i.e., separating from the central axis at the end of the first year when the cone is ripe. A characteristic feature is the development of numerous horizontal resinous pockets often an inch long just below the surface while the stem is still in the smooth bark stage. These, however, also occur in the young stems of the Douglas Fir and of the Engelmann Spruce. These pockets yield balsam and turpentine.

A. Bract scales each with a long point longer than the scales and projecting all over the cone .. .. *A. bracteata.*

B. Bract scales projecting beyond the placental scales, but the tip short 6

C. Bract scales not projecting* beyond the placental scales, i.e., hidden in the ripe but unexpanded cone 1

1. Leaves silvery white beneath 2
   Leaves green or hardly silvery white beneath 4

2. Cones orange brown .. .. *A. Cilicica.*
   Cones dark purple 3

3. Usually at low elevations .. .. *A. amabilis.*
   Alpine trees growing at high elevations .. .. *A. lasiocarpa.*

4. Leaves under 2 cm. long 5
   Leaves over $2\frac{1}{2}$ cm. to 3 cm. long .. .. .. *A. Fortunei.*

5. Cones 10 cm. to 15 cm. long .. .. .. *A Pinsapo.*
   Cones brownish yellow 5 cm. to 8 cm long .. .. *A. Pichta.*
   Cones purple 6 cm. to 10 cm. long .. .. .. *A. balsamea.*

6. Larger cones over 15 cm. long 7
   Cones 12 cm. to 15 cm. long 8
   Cones 5 cm. to 10 cm. long 9

7. Surface of cone covered by projecting recurved bract scales *A. nobilis.*
   Surface of cone exposed normally .. .. *A. cephalonica.*

8. Leaves 3 cm. long .. .. *A. Nordmanniana.*
   Leaves 2.5 cm. long .. .. *A. alba.*

9. Leaves thin and flexible, deeply grooved, dark green above, silvery white beneath .. .. *A. grandis.*
   Leaves differing in one or other of these features 10

10. Leaves 2 cm. long .. .. *A. Fraseri.*
    Leaves 3 cm. long .. .. *A. Eichleri.*
    Leaves 3 cm. to 4.5 cm. long .. .. .. *A. concolor.*

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* When the cone is ripe but the scales unexpanded. When the scales open the bract scales can still be seen projecting beyond the placental scales at the base of the cone, although they may really be shorter than the placental scales.

Abies alba (*A. pectinata*). Silver Fir, Europe. A tree reaching a height of 100 feet to 150 feet or more, at first pyramidal, later with a blunt crown. Leaves average 2½ cm. long, mostly two-rowed, and with two bluish white stripes beneath. Cones mainly at the ends of the branches, 12 cm. to 15 cm. long and about 4 cm. diameter when unexpanded. Wood pale, soft but tough, with a smooth silky grain. Used for matches, boxes, furniture, sounding boards, &c. Yields also resin and turpentine. It suffers from severe dry heat and also from intense cold. The early growth is very slow, but from the twentieth to the thirtieth year it may grow 2 feet to 3 feet a year. The slow early growth is a general characteristic of most Firs, and often leads to their suppression when re-establishing a mixed forest.

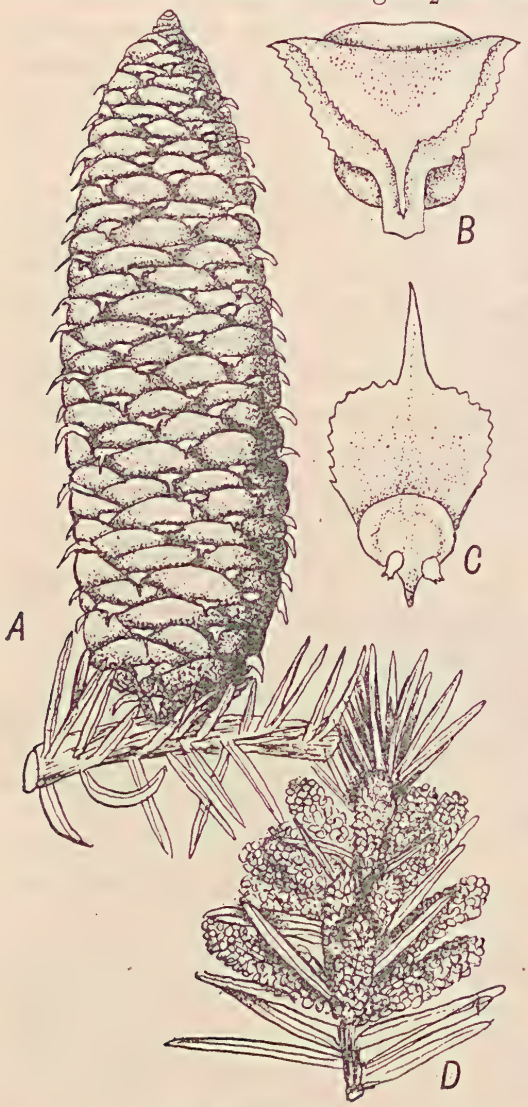

Fig. 58. *Abies alba.*

A. Female cone and leaves.
B. Cone scale from beneath, the bract scale bent sharply back to show the placental scale.
C. Young cone scale from above, the bract scale projecting beyond the enlarging placental scale with its two ovules.
D. Inflorescence of male cones (all nearly half natural size).

A. balsamea, Eastern United States (25 feet to 80 feet), differs in having shorter needles, but has similar cones about 3 cm. diameter and usually up to 10 cm. or 12 cm. long, but sometimes shorter. It yields Canada balsam, as also does *A. Fraseri* (30 feet to 40 feet, North Carolina), which differs in being smaller in all its parts and having shorter and more oval cones. The wood of both is of moderate quality and they are only second grade timber trees. That of *A. balsamea* is pale, soft, knotty, not durable and rarely used except for box slats. A cubic foot weighs 23 lb. to 24 lb. It grows to an age of 100 to 150 years, then attaining a diameter of 12 inches to 18 inches, but in very close stands sometimes not more than 4 inches to 6 inches.

A. Cilicica. (Asia Minor and the Lebanon, at high elevations.) A hardy tree reaching a height of 40 to 60 feet and a diameter of 1 to 3 feet. It is slow in growth and is of little use as a source of timber. The cones are 5 to 6 inches long.

A. Nordmanniana (Crimea and Caucasus) resembles a large fine specimen of *A. alba*, but has longer leaves (2 cm. to 3 cm. long), silvery beneath, cones 10 cm. to 15 cm. long, and is much grown in parks. It is hardy and stands exposure well. A very graceful tree rarely grown for timber. It suffers from hot dry winds, and usually does not start to grow until November, then growing rapidly for two months.

A. Pinsapo, Spanish Fir (Spain and North Africa), has hard pointed spreading greyish green needles averaging $1\frac{1}{4}$ cm. in length. Cones 12 cm. to 15 cm. long and half as broad as long. It attains 70 feet to 80 feet, but does not stand severe cold. A much branched tree of compact habit.

A. Pichta (*A. Sibirica*) (North-East Russia and Siberia) is possibly a dwarf northern form of *A. alba*, with shorter leaves and smaller cones. It may, however, exceed 60 feet in height and stands cold well.

A. Fortunei (China) has the habit of the Himalayan Cedar. It has stiff leaves, $2\frac{1}{2}$ cm. to 3 cm. long and bright green on both sides. The cones are about 15 cm. long and the broad concave cone scales persist for some time after the fall of the seed. It is more a garden than a timber tree.

Fig. 59. *Abies Nordmanniana.*

A. Female cone and leaves.
B. Cone scale from above showing the two winged seeds.
C. Cone scale from below showing the narrow bract scale (all nearly half natural size).

A. concolor, White Fir (New Mexico and Rocky Mountains) also has the leaves almost equally green on both sides but 3 cm. to 6 cm. long and arranged in double rows, the lower row longer. It reaches 80 feet to 150 feet high, with a diameter of 3 feet to 5 feet and an age of 200 to 300 years, and has cones 7 cm. to 12 cm. long, or even more, with very broad scales and short blunt bracts between them. It is very hardy, grows rapidly and is fairly resistant to heat and drought and can adapt itself to various soils. It should be worthy of trial in many Mallee districts where a choice of good shade and shelter trees is difficult. It grows best, however,

Fig. 60. *Abies concolor.*
Unopened female cone and leaves (slightly reduced).

Fig. 61. *Abies bracteata.*
Female cone with projecting tips of bract scales (slightly reduced).

in cool moist situations at high elevations and its most rapid growth is usually in the first 50 years. The wood is pale, soft and straight grained. It is useful for general purposes, and is moderately strong. A cubic foot weighs 22 lb. to 23 lb.

A. bracteata (*A. venusta*), Bristle-cone Fir (Oregon and California) is easily distinguished from all other species by the long tapering ends of the bracts projecting all over the cones and longer than the bracts themselves. It is a tall tree, 60 feet to 100 feet high, 20 inches to 30 inches diameter and attaining 100 to 150 years age. It is of rather rapid growth and averages 1 foot diameter per 60 years. The wood is light yellowish brown, dense and firm, but moderately soft. The early growth is slow. The young shoots suffer from frost at low elevations, but it is hardy at higher elevations because growth starts later. The timber has not been used commercially owing to the lack of supplies but the tree is useful for protective cover on dry, exposed mountain sides and also grows well in moist valleys.

A. grandis, Western White Fir (North California to Montana, Washington and British Columbia) is a tree attaining 150 feet to 200 feet or more in height with a diameter of 3 feet to 4 feet and an age of 150 to 200 years. It has cylindrical cones 8 cm. to 12 cm. long and 4 cm. to 5 cm. diameter, rather flat at the top. The leaves are silvery white beneath, are arranged in two double rows, and are from 2 cm. to 3 cm. long. To grow well it requires good conditions of soil, light, and exposure. It is resistant to frost, but requires moist situations usually at elevations between 2,000 and 7,000 feet. It does not grow well where shaded by

other trees. The wood is brownish white, without resin pores, with a fine even grain. It is fairly soft and easily worked, but not very durable or very strong, but can be used for boxes, slats and all purposes where strength is required. A cubic foot weighs 22 lb. to 23 lb.

A. amabilis.—The Amabilis Fir has a similar range and forestral characters to the preceding but the bracts are hidden instead of projecting slightly and the bark is smooth and grey with white patches. The timber is similar but somewhat more valuable when obtainable. The tree averages 1 foot diameter per 125 years and lasts 200 to 300 years.

Fig. 62. *Abies grandis.* Unopened female cone, the bract scales hidden (slightly reduced).

A. Eichleri (Caucasus). This is probably a small mountain form of *A. Nordmanniana.*

A. lasiocarpa. Alpine Fir. An alpine tree of West America extending from Alaska to Mexico, at elevations up to 3,500 feet in the north and up to 10,000 feet in the south. It averages 50 feet to 100 feet with a diameter of 1 foot to 2 feet and may then be 100 to 200 years old. Cones 2 inches to 4 inches long. Bract scales pointed hardly half the length of the cone scales. Wood pale, soft, with narrow rings, usually straight grained but not strong or durable, and knotted owing to the persistence of the basal branches. It is little used. A cubic foot weighs 20 lb. to 22 lb. A local variety known as *A. arizonica*, the cork fir, has a soft corky bark and more quadrangular bract scales (instead of rounded) with a blunter pointed tip.

A. nobilis, Red Fir (Oregon or Shasta Red Fir, *A. magnifica*, of California and Nevada) has cones 10 cm. to 20 cm. long and 5 cm. to 7½ cm. diameter and attains a height of 150 feet to 250 feet with a diameter of 3 feet to 5 feet and an age of 250 to 350 years. It has thin pointed bracts projecting beyond and reflexed over the fruiting scales, occasionally in some cones the bracts are hidden. It is an important timber tree. The wood is yellowish brown, soft, but firm, moderately durable and strong. A cubic foot weighs 29 lb. to 30 lb. It stands frost and forms fruits while still young. The growth is fairly rapid. It grows best at high

elevations over 5,000 feet and on moist soils. It is intolerant of shade. The bark is often blistered and a yellowish turpentine exudes from these blisters when an incision is made.

Fig. 63. *Abies nobilis.*
Female cone with projecting reflexed tips of bract scales (nearly half natural size).

A. cephalonica (Cephalonia) has rigid sharp pointed leaves standing out at right angles to the branches, and cylindrical cones pointed at the top and the larger ones over 15 cm. in length and about 4 cm. diameter. It attains a height of 50 feet to 70 feet. It stands dry conditions and exposure fairly well, but suffers from severe cold, particularly when grown in sheltered low elevations. This is largely because the sensitive young shoots are then apt to develop too early in the season.

TAXODAE.

The cones ripen in one year, rarely in two.

KEY TO GENERA.

Leaves in whorls, linear 5 cm. to 10 cm. long and with blunt ends and smooth edges .. .. *Sciadopitys.*

Leaves clustered, 3 cm. to 6 cm. long with serrate edges and pointed *Cunninghamia.*

Leaves not in whorls, and, if closely clustered, scale-like or pointed and with smooth edges 2

2. Cones 5 cm. to 6 cm. long and egg-shaped or like a small pine cone *Sequoia.*

Cones 1 cm. to 3 cm. long, more or less globular, hardly like a pine cone 3

3. Cone scales with a single point 4

Cone scales toothed and with a recurved point, each scale with three to five seeds with narrow wings, leaves narrow or pointed, 1 cm. to 2 cm. long .. .. .. *Cryptomeria.*

4. Shrubs rarely attaining 20 feet to 30 feet .. .. *Athrotaxis.*

Trees 50 feet to 100 feet high .. .. .. *Taxodium.*

Sciadopitys.—This genus of a single species, *S. verticillata*, the Parasol Pine, is native to Japan. It forms a tree 50 feet to 100 feet high. The flat linear, glossy dark green leaves are really dwarf shoots composed of two needles 5 cm. to 10 cm. long fused together, and arranged in whorls of 20 to 30 above a row of short scale leaves. The cylindrical cones are

) cm. to 10 cm. long, the scales large and broad, each with six to nine seeds; a leafy axis often grows through the apex of the cone. The tree is of slow growth and requires shelter and a good moist soil. The timber is valued in Japan. It is very pale and strong with a straight grain.

Cunninghamia is also a genus of a single species native to South China (*C. sinensis*). It only attains 30 feet to 40 feet in height. The cones are rounded and 3 cm. to 5 cm.

Fig. 64. *Sciadopitys verticillata.*

A. Female cone.
B. Whorl of leaves with male cones.
C. Female cone scale showing seven bordered seeds (all somewhat reduced).
D. Stamen from male cone (magnified).

diameter and something like a Jerusalem Artichoke in appearance with pointed overlapping scales, each scale with three narrow winged seeds. The leaves are lanceolate, pointed and 2 cm. to 5 cm. long. More a decorative than a timber tree. It requires warmth, shelter and moist soil.

Fig. 65. *Cunninghamia sinensis.*

A. Female cones; B. male cones; C. leaf with three nerves; D. stamen with three pollen sacs; E. carpellary scale with three seeds. (A. & B, slightly reduced. C. & E, about natural size. D, magnified).

ATHROTAXIS.

This is a genus of three species confined to Tasmania. All are shrubs or small trees, rarely 30 feet in height with small crowded leaves. The cones are ovate, under an inch in length, the scales numerous and each with three to six seeds.

A. cupressoides, the King William Pine, has foliage of short closely appressed scale leaves 3 cm. to 4 cm. long. Cones under 1 cm. diameter. Attains 25 feet to 40 feet. A cubic foot of the wood weighs 22 lb. It is pink to pinkish yellow, light, but tough and durable and with a cedar-like smell. It is used for cabinet work and for making light rowing sculls, mouldings, &c.

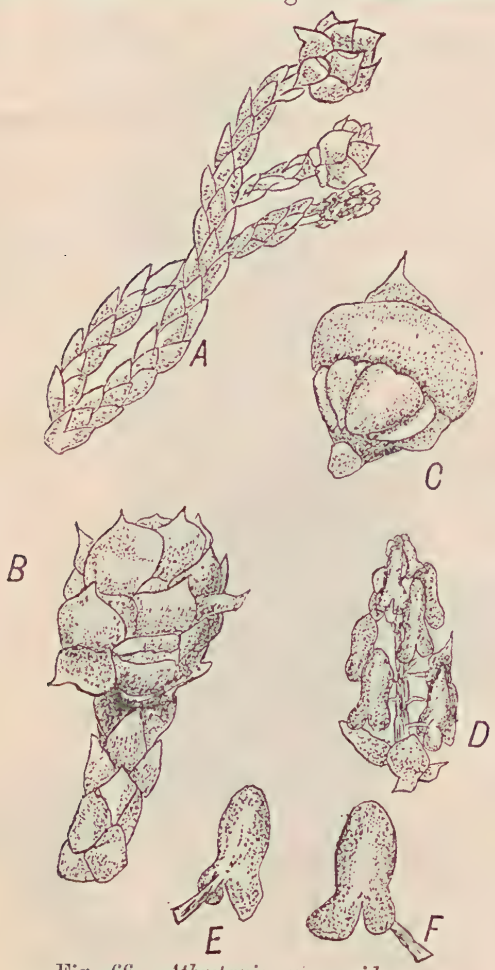

Fig. 66. *Athrotaxis cupressoides.*

A. Branch with leaves, a young, an older and a ripe cone (natural size).
B. Ripe female cone (enlarged).
C. Scale from female cone with five seeds.
D. Male cone with stamens.
E. and F. Stamens (C, D, E and F all magnified).

A. selaginoides has leaves about 1 cm. long and cones 1 cm. to 2 cm. diameter. It varies from 3 feet to 15 feet or rarely 20 feet in height. This and the preceding plant have little timber value but they are hardy and are often grown as decorative shrubs. A cubic foot weighs 22 lb. to 25 lb. and the wood resembles that of *A. cupressoides*.

A. laxifolia is similar but has the leaves separated, longer, pointed and spreading and the stems thinner. It reaches 15 feet to 25 feet.

Fig. 67. *Cryptomeria japonica.*

A. Leafy shoot with male cones on the left and a female cone on the right (somewhat reduced).
B. Male cones (natural size).
C. Seed.
D. Male cone scale with anthers.
E. Female cone scale from beneath.
F. Female cone scale from side with two ovules (C–F all enlarged).

Cryptomeria.—This is a genus of a single species *C. japonica* (Japanese Cedar), native to Japan but now widely grown in numerous varieties (elegans, nana, Lobbi, &c.) as a decorative plant. Cones globular over 1 cm. diameter, scales numerous

each with three to five seeds. Leaves closely set, appressed to stem. As in the case of the preceding three genera it is grown more as a decorative than as a timber tree, but in Japan it attains 100 feet in height and yields a fairly soft but strong and durable, scented, easily worked, reddish or nut-brown timber. The annual rings are narrow and marked by alternate yellow and brown streaks, and it contains sparkling spots of resin. A cubic foot weighs 30 lb. It grows best in moist mountain valleys, where its growth is fairly rapid but in exposed situations it becomes dwarfed and the growth is slow.

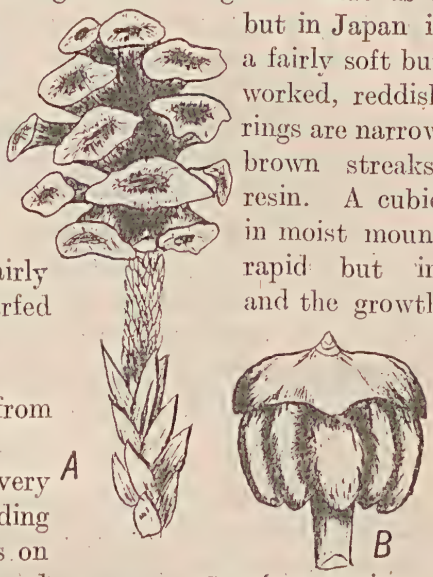

Fig. 68. *Sequoia sempervirens.*
A. Leaves and open female cone (natural size).
B. Female cone scale from above with five seeds (enlarged).

SEQUOIA.

A genus of two species, both from Western U.S.A.

S. sempervirens. Red Wood. A very tall tree 200 feet to 335 feet high extending from Oregon to California, the leaves on sterile shoots 1 cm. to 2 cm. long and more or less two-rowed, those on fertile shoots shorter and more scale like. Cones 2 cm. to 3 cm. long usually. Wood rich red, with a sharply defined pale sap-wood. Annual rings and medullary rays narrow but well defined. Tracheides large. Minute, red bead-like resin cells are present in the wood. A cubic foot weighs 25 lb. to 30 lb. Very soft, somewhat brittle, not very strong, but fairly durable. It seasons well with very little shrinkage. A very valuable soft wood timber, for cornices, mouldings, beading and panelling. It can also be used for pencils. The tree is sensitive to frost and requires warm sheltered conditions. The growth in Victoria is slow and the later growth in California is also slow. Hence well matured trees are already becoming scarce. Maximal duration 1,500 years, during which period the diameter growth averaged 1 foot per 65 to 70 years.

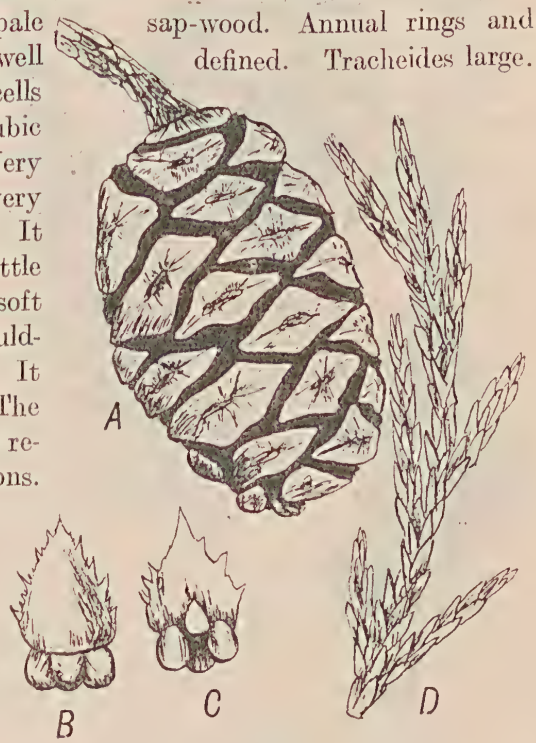

Fig. 69. *Sequoia gigantea.*
A. Open female cone.
D. Branch with leaves (both about natural size).
B. and C. Upper and lower sides of male cone scales with anthers of *S. sempervirens* (both enlarged).

S. gigantea. The Giant Red-wood. This attains a height of 200 feet to 330 feet and a basal circumference of 45 feet to 60

feet, 10 feet from the ground, and it shares with *Eucalyptus regnans* the distinction of being the tallest tree. Without having the slender trunk of *E. regnans* it is less massive than *S. sempervirens*. The timber is closely similar, equally durable and rich in tannin, but lighter and coarser grained, brittle, soft and spongy. A cubic foot weighs 24 lb. when seasoned. The colour varies from pale yellow to red with a broad layer of white sapwood. It does not appear much on the market. The tree attains an age of 2,000 to 2,500 years. Leaves usually closely appressed and scale-like, the longer ones up to 1 cm. long. Cones ovoid, with a blunt top 5 cm. to 8 cm. long. Each cone scale has five to nine seeds. The Redwoods require an equable climate, rich soil, sheltered valleys, and moist air. In Victoria growth is usually very slow. Broken young trees sprout readily from the top but not from the stump or root.

TAXODIUM.

A genus of two North American and two Chinese species. The two latter (*T. heterophyllus* and *T. sinense*) have a wing at the base of the seed, but have no value as timber trees. In the two former the seed is angular but not winged, and both have some value for timber.

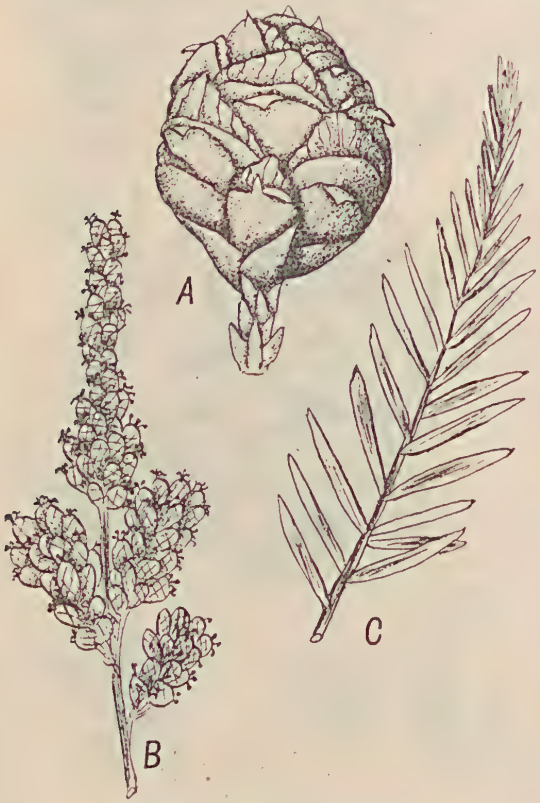

Fig. 70. *Taxodium distichum.*

A. A male cone.
B. Male inflorescence.
C. Branch with leaves.

T. distichum. Virginian Swamp Cypress. It grows naturally in swamps and wet places in the South-Eastern States of America and is also often planted in Europe. Leaves deciduous, narrow linear, 1 cm. to 2 cm. long, cones 2 cm. to 3 cm. diameter and globose. It has a massive butt and attains a height of 80 feet to 100 feet or more. Its horizontal roots develop peculiar conical upgrowths often 2 feet to 6 feet or more in length known as Cypress Knees. These have soft, light, spongy wood and bark, and as they rise above the water or mud they may serve as breathing roots. They arise usually just over the downwardly descending anchor roots. The wood is valuable when obtainable and the tree yields resin and turpentine. The wood is slightly resinous but contains no resin canals. Although not very

strong, the wood is easily worked and is durable. It is used in construction and is brown to yellow or yellowish red, soft and light, with a close straight grain. The autumn wood in the annual ring is much darker and harder than the spring wood, and it often shows fine light and dark bands concentric with the rings. It lasts well in outhouses and greenhouses, even when unpainted, but develops a ridged surface as it weathers. The growth is slow and the tree requires shelter from wind and moist soils.

T. mexicanum. Mexican Swamp Cypress. It attains a height of 100 feet to 150 feet, a diameter of 15 feet to 20 feet, and an age of over 2,000 years. The wood is valuable when obtainable in quantity. The leaves are evergreen, but the tree is sensitive to cold.

Fig. 71. *Taxodium heterophyllus.*
A. Branch with leaves and female cones.
B. Seed with basal wing.
C. Female cone scale with winged seeds.

T. heterophyllus (China).—This rarely exceeds 8 feet to 10 feet and has scale-like leaves on the larger, and spreading, narrow, pointed, somewhat three-angled leaves on the smaller branches. Cones narrow, ovoid, about 2 cm. long, each fertile scale with two winged seeds. It only grows well in moist, sheltered situations.

KEY TO THE COMMONER DICOTYLEDONOUS TREES AND LARGER SHRUBS, PLANTED OR GROWING WILD IN VICTORIA, BUT NOT NATIVE.

1. Fruit trees grown in orchards and gardens 2
   Timber or shade trees grown in parks, avenues or plantations or shrubs growing wild 20

2. Fruits, nut like or enclosing nuts 3
   Fruit fleshy 8
   Fruit with internal membranous subdivisions and fleshy seeds *Punica granatum* (Pomegranate).

3. Fruits large and brown with a leathery skin, two or three enclosed by a burr-like involucre 4
   Nut enclosed in a greenish non-spiny shell, which splits, exposing the nut 5
   Nut enclosed by a greenish non-spiny cupule attached at the base only 7

4. Tree 50 feet to 100 feet, leaves 6 inches to 10 inches long, nuts under 1 inch in diameter .. .. *Castanea americana* (American Chestnut).
   Tree 50 feet to 70 feet, leaves 5 inches to 9 inches long, nuts over 1 inch in diameter .. *Castanea sativa* (European Chestnut).

5. Nut flattened .. .. .. *Prunus amygdalus* (Almond).
   Nut rounded 6

6. Leaflets five to thirteen almost entire, tree 70 feet *Juglans regia* (English Walnut).
   Leaflets thirteen to twenty-five, serrate, tree up to 150 feet *Juglans nigra* (Black Walnut).

7. Shrub, 3 feet to 8 feet, nut $\frac{1}{2}$ inch long *Corylus americana* (American Hazel).
   Shrub 12 feet to 15 feet, nut $\frac{1}{2}$ inch to $\frac{3}{4}$ inch long *Corylus Avellana* (Hazel Nut).
   Shrub, 10 feet to 20 feet, nut large, broadly ovate *Corylus pontica* (Cob Nut).
   Shrub or small tree up to 30 feet, nut large and oblong *Corylus maxima* (Filbert).

8. Fruit with a hard central stone enclosing the seed 9
   Fruit with a scaly or cartilaginous core 14
   Fruit without any scaly core or stone, but subdivided into quarters 16
   Fruit with one or more central glossy brown stones (seeds), over half the diameter of the fruit, pulp firm *Eriobotrya japonica* (Loquat).
   Fruit with several large seeds, less than half the diameter of the fruit, or none, pulp gelatinous .. *Diospyros Kaki* (Persimmon).
   Fruit blackberry like, white, red or black 8A
   Fruit with small "seeds" embedded in the central pulp *Ficus Carica* (Fig).

8A. Leaves deeply cut 79
Leaves not deeply cut 8B

8B. Fruits white or pale violet .. .. *Morus alba* (White Mulberry).
Fruit dark red .. .. .. *Morus rubra* (Red Mulberry).
Fruits black when fully ripe .. .. *Morus nigra* (Black Mulberry).

9. Skin of fruit smooth and shiny, pulp watery 10
Skin of fruit woolly or more or less rough or velvety 13
Skin of fruit smooth, pulp oily .. .. *Olea europaea* (Olive).

10. Fruits small and cherry like, yellow, black or red, 1 inch or less in length 11
Fruit large and plum like, over 1 inch in length, usually purplish, less often reddish 12
Fruit large and peach like, red and yellow, stone furrowed
Prunus persica var. *laevis* (Nectarine).

11. Fruit slightly grooved on one side, the stone flattened
Prunus cerasifera (Cherry Plum).
Fruit with a line (sometimes faint) on one side, but hardly grooved, the stone nearly round .. *Prunus Avium* (Sweet Cherry).

12. Young twigs hairy, leaves and fruit large
Prunus domestica (Garden Plum).
Young twigs hairy, leaves and fruit small
Prunus domestica var. *damascena* (Damson Plum).
Young twigs smooth or nearly so *Prunus triflora* (Japanese Plum).

13. Leaves roundly ovate to slightly heart shaped
Prunus armeniaca (Apricot).
Leaves broadly lanceolate to oblong lanceolate *Prunus persica* (Peach).

14. Fruit with five chambers, each with one or two seeds 14A
Fruit with five chambers, each with more than two seeds
Cydonia vulgaris (Quince).

14A. Fruit with gritty cells, especially near the core. Leaves smooth
Pyrus communis (Pear).
Fruit without any gritty cells in the pulp. Leaves more or less woolly beneath 15

15. Fruits under 1 inch diameter, stalks 2 inches to 3 inches long
Pyrus baccata (Crab Apple).
Fruits over 1 inch diameter, stalks shorter *Pyrus Malus* (Apple).

16. Fruits barely 2 inches long, rind loosely adherent
Citrus nobilis (Mandarin).
Fruits over 2 inches long, rind firmly adherent 17

17. Fruit 5 inches to 7 inches in diameter
Citrus Decumana (Grape Fruit or Pumelo).
Fruit under 5 inches diameter 18

18. Fruit 5 inches to 7 inches long, rind very thick
Citrus medica var. *genuina* (Citron).
Fruits rarely reaching 5 inches length, rind thin or moderately thick 19

19. Rind orange, pulp sweet .. .. *Citrus aurantium* (Orange).
Rind orange, pulp sour .. *C. aurantium* var. *amara* (Seville Orange).
Rind yellow, pulp sour, petiole (leaf-stalk) round and hardly winged
C. medica var. *limon* (Lemon).
Rind yellow, pulp sour, petiole flattened with narrow wings
C. medica var. *acida* (Lime).

20. Flowers small, green, or yellowish and inconspicuous, although sometimes in more prominent clusters and then more or less coloured as a whole 21

Flowers more conspicuous, usually fairly large and brightly coloured 50

Flowers small and white, in conspicuous clusters 20A

20A. Height 5 to 12 feet, leaves compound *Sambucus nigra* (European Elder).

Height, 12 to 25 feet, leaves compound *Sambucus canadensis* (American Elder).

Height 10 to 20 feet, leaves simple, glossy green *Prunus lauro-cerasus* (Cherry Laurel).

21. Flowers staminate or carpellary, and each kind on male and female trees respectively 22

Flowers staminate and carpellary or sometimes hermaphrodite, but all on the same individual tree. Leaves pinnate or palmately lobed 26

Flowers male or female on the same tree, but not hermaphrodite. Leaves simple or pinnate 28

Flowers always hermaphrodite 50

22. Scales at the base of the catkins green and falling early .. 23

Scales at the base of the catkins black outside, and persisting .. 24

23. The end branches usually not very drooping. Stamens more than three .. .. *Salix nigra* (Black Willow)

The end branches very drooping. Stamens two or three to each flower scale .. *Salix babylonica* (Napoleon's Willow).

24. Stamens one to each flower scale .. *S. purpurea* (Purple Osier).

Stamens two to each flower scale 25

25. Leaves green and 2 inches to 5 inches long *Salix Capraea* (Goat Willow).

Leaves silvery, narrower, and 4 inches to 8 inches long *Salix viminalis* (Osier Willow).

26. Fruit a singly winged key, leaves pinnate 26A

Fruit doubly winged. Leaves usually palmate 71

Fruit a flat edible pod .. *Ceratonia siliqua* (Locust Tree).

26A. Leaflets with glands at the tips of the teeth. Tree suckering readily *Ailanthus glandulosa* (Chinese Tree of Heaven).

Leaflets without glands. Tree not suckering readily from the roots 27

27. Buds grey, 25 feet .. .. *Fraxinus Ornus* (Flowering Ash).

Buds brown, 100 feet .. .. *Fraxinus americana* (White Ash).

Buds black, 100 feet .. *Fraxinus excelsior* (Common Ash).

28. Leaves pinnately compound 29

Leaves not compound 30

29. Fruit small, red and berry like .. *Schinus molle* (Pepper Tree).

Fruit a large nut enclosed in a fleshy shell, or husk 29A

29A. Fruit husk not splitting or splitting into two. *Juglans* (Walnut) 6

Fruit husk splitting into four valves. *Carya* (Hickory) .. 29B

29B. Leaflets 3 to 7, nut small, kernel astringent. *Carya porcina* (Pignut).

Leaflets 7 to 9, nut small, kernel sweet *Carya tomentosa* (C. alba) (Mockernut).

Leaflets 11 to 17, nut medium size, kernel sweet *Carya olivaeformis* (Pecan).

30. Tree exuding a milky sap when injured
Ficus macrophylla (Moreton Bay Fig).
Tree not exuding a milky sap 31

31. Fruit a small triangular nut enclosed in a prickly shell 32
Fruit a large nut (acorn) seated in a hollow cup 33
Fruit a capsule with minute hairy seeds 40
Fruit a small seed-like nut without any wing and not enclosed in a cup or prickly involucre 44
Fruits small in globular clusters of about 1 inch diameter .. 45
Fruits small and winged 46
Apparent fruits large, yellowish-green and rounded. Plant with thorns .. .. .. *Maclura aurantiaca* (Osage Orange).

32. Leaves with a distinctly serrate edge *Fagus ferruginea* (American Beech).
Leaves with a slightly indented but hardly serrate edge
Fagus sylvatica (European Beech).

33. Foliage turning scarlet in autumn *Quercus coccinea* (Scarlet Oak).
Foliage turning dark-red in autumn *Quercus rubra* (Red Oak).
Foliage turning yellow, brown or brownish red 34

34. Male catkins erect, with female flowers at the base
Quercus densiflora (Tan Bark Oak).
Male catkins pure and drooping 35

35. Leaves deciduous 36
Leaves evergreen 38

36. Acorn cup with closely adherent scales 37
Acorn cup with spreading scales and curved tips
Quercus Cerris (Turkey Oak).

37. Fruits stalked .. *Quercus pedunculata* (*Q. robur*) (English Oak).
Fruits hardly stalked *Quercus sessiliflora* (*Q. robur*) (Erect Oak).

38. Scales of cup thick. Bark corky .. *Quercus suber* (Cork Oak).
Scales of cup thin. Bark hardly corky 39

39. Cup half the length of the acorn .. . *Quercus Ilex* (Holly Oak).
Cup one third the length of the acorn
Quercus virens (*Q. virginiana*) (Live Oak).

40. Terminal buds small and not sticky 41
Terminal buds large and sticky 42

41. Leaves white beneath .. .. *Populus alba* (White Poplar).
Leaves not white beneath .. .. *Populus tremula* (Aspen Poplar).

42. Leaf stalks flattened and leaves trembling in the wind 43
Leaf stalks rounded or channelled and leaves firmer
Populus balsamifera (Balsam Poplar).

43. Leaves triangular .. *Populus canadensis* (*P. deltoides*) (Cottonwood).
Leaves more rounded *Populus nigra* (Black or Lombardy Poplar).

44. Leaf veins ending mostly in the indentations
Alnus japonica (Japanese Alder).
Leaf veins ending mostly in the larger leaf teeth
Alnus glutinosa (Black Alder).

45. Leaf lobes shorter than broad *Platanus occidentalis* (American Plane).
Leaf lobes longer than broad *Platanus orientalis* (Oriental Plane).

46. Male flowers in elongated catkins 47
Male flowers in short dense clusters 48

47. Scales of catkins five lobed .. *Alnus viridis* (Green or Mountain Alder).
Scales of catkins three lobed .. *Betula alba* (White Birch).

48. Flowers drooping on long stalks 49
Flowers on short stalks erect in dense clusters
Ulmus campestris (English Elm).

49. Branches with corky wings (also in var. *suberosa* of English Elm)
Ulmus racemosa (Cork Elm).
Branches without corky wings .. *Ulmus americana* (White Elm).

50. Flowers rather small in long drooping pinkish sprays, leaves small and simple *Tamarix gallica* (Tamarisk).
Flowers small in clusters, each flower with a fringed staminal tube, leaves large and pinnate .. .. *Melia Azederach* (White Cedar).
Flowers small in umbels in the axils of the leaves, which are large smooth and bright green; fruits purple and cherry-like
Laurus nobilis (Sweet Bay or Laurel).
Flowers not very small, or if in drooping sprays, not pinkish .. 51

51. Flowers resembling a pea blossom 52
Flowers not resembling a pea blossom 57

52. Plant with spines 53
Plant without spines, although the branches are sometimes slender and pointed. Pod several seeded 54
Pod one seeded .. .. *Psoralea pinnata* (Pinnate Psoralea).

53. Leaves not spiny, the spines short and on the branches or stems only. Fruit pod like, leaves not scented *Robinia pseudacacia* (Robinia).
Leaves and branches spiny and sharp pointed *Ulex europaeus* (Gorse).

54. Flowers white .. .. .. *Cytisus proliferus* (Tagasaste).
Flowers pink to purple .. *Cytisus purpureus* (Purple Cytisus).
Flowers wholly or mainly yellow 55

55. A small tree 15 feet to 20 feet .. *Cytisus Laburnum* (Laburnum).
Shrubs rarely exceeding 10 feet. Leaves stalked 56
Leaves nearly sessile and silvery beneath *Cytisus linifolius* (Flax Broom).

56. Flowers lateral along the branches *Cytisus scoparius* (Scotch Broom).
Flowers in terminal racemes
Cytisus canariensis (Canary Broom or "Genista").

57. A slender tree with compound pinnate leaves and red berries
Pyrus aucuparia (Rowan Ash).
A small tree with large tulip-like sweet scented flowers
Liriodendron tulipifera (Tulip Tree).
A shrub or small tree with prickly leaves and red berries
Ilex aquifolium (European Holly).
A shrub, fruit berry like, leaves scented *Rosa rubiginosa* (Sweet Briar).
A shrub or small tree, not exceeding 15 feet to 20 feet, with simple leaves, thorny branches and red or occasionally yellow fruits .. 58

57 (*cont.*) Bramble-like shrubs, with "blackberry" fruits .. 79
Trees usually exceeding 20 feet, fruits not red and leaves simple or not pinnately compound 64
A shrub or small tree with red strawberry-like fruits
Arbutus Unedo (Irish Strawberry).

58. Berry crowned at the top by the calyx 59
Berry smooth at the top, the calyx beneath it 62

59. Leaves not lobed or divided 60
Leaves lobed or divided 61

60. Fruits scarlet and spherical
Crataegus Crus-Galli (Larger Scarlet Thorn).
Fruit bright red and ovate .. *Crataegus coccinea* (Scarlet Thorn).

61. Fruits round .. .. *Crataegus oxyacantha* (Hawthorn).
Fruits ovate .. .. *Crataegus monogyna* (Red Hawthorn).

62. Leaves over $\frac{3}{4}$ inch long .. *Lycium chinense* (Chinese Boxthorn).
Leaves under $\frac{3}{4}$ inch long 63

63. Flowers small, whitish .. .. *Lycium horridum* (Boxthorn).
Flowers about 1 inch long, purple *Lycium afrum* (African Boxthorn).

64. Fruits large and prickly, the seeds like chestnuts. Leaves with five to seven digitate leaflets 65
Fruits small, not prickly; leaves simple or lobed, but not compound

65. Flowers pale or white, leaflets unstalked, large tree 66
Aesculus Hippocastanum (Horse Chestnut).
Flowers red, leaflets shortly stalked, small tree
Aesculus Pavia (Pavia Chestnut).

66. Fruits attached by a stalk to the centre of a large wing (bract) .. 67
The wings double and attached directly to the fruit 71

67. Slender branches drooping .. *Tilia petiolaris* (Weeping Linden).
Branches erect 68

68. Petals erect, longer than the stamens 69
Petals spreading, shorter than the stamens 70

69. Leaves whitish beneath, fruit ribbed *Tilia heterophylla* (White Linden).
Leaves white beneath, fruit smooth *Tilia tomentosa* (Silver Lime).
Leaves green beneath *Tilia americana* (American Linden or Basswood).

70. Leaves hairy beneath *Tilia platyphyllos* (*T. europaea*) (European Lime).
Leaves smooth beneath, except for a whitish tuft of hairs in the axils of the veins. Flowering a fortnight later than the preceding species
Tilia vulgaris (*T. europaea*) (Late European Lime or Berlin Linden).

71. Leaves 8 inches to 12 inches across
Acer macrophyllum (Large-leaved Maple).
Leaves less than 8 inches across 72

72. Leaves simple, usually palmate 73
Leaves with three to five pinnately arranged leaflets
Acer Negundo (Ash-leaved Maple).

73. Flowers in dense lateral clusters, appearing before the leaves .. 74
Flowers stalked, appearing with or after the leaves .. ..

74. Flowers and autumn foliage yellow, leaves silvery beneath
Acer saccharinum (*A. dasycarpum*) (Silver Maple)

Flowers and autumn foliage red, leaves pale, but not silvery beneath
Acer rubrum (Red Maple).

75. Flowers without petals and the sepals united
Acer saccharum (Sugar Maple).

Flowers with petals, and the sepals free 76

76. Flowers yellowish green 77

Flowers purple 78

77. Leaves under 4 inches across .. .. *Acer campestre* (Maple).

Leaves over 4 inches across *Acer platanoides* (Norway Maple).

78. Flowers small, leaves and leaf stalks not hairy
Acer palmatum (Japan Maple).

Flowers large, leaves and leaf stalks hairy when young
Acer japonicum (Japanese Maple).

79. Plant densely covered with reddish brown hairs
Rubus phoenicolasius (Hairy Bramble).

Plant not densely covered by hairs 80

80. Fruit red .. .. .. *Rubus Idaeus* (Raspberry).

Fruit black, leaflets not subdivided *Rubus fruticosus* (Blackberry).

Fruit black, leaflets deeply cut *Rubus laciniatus* (Cut-leaf Bramble).

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